USER MANUAL
RKP-II

Radial Piston Pump

CA53461-001; Version 1.0, 10/07

WHAT MOVES YOUR WORLD

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For your Notes.

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1 General Information

1.1 Information on the User Manual

Information on the User Manual

The User Manual at hand refers solely to the radial piston pumps in the series RKP-II and is an integral part of the product. It describes the intended use and safe application of the product in all phases of operation.

1.1.1 Target Groups

1.1.1.1 Operator

Target Group: Operator

Among other things, the operator must ensure that the trained staff working with the radial piston pump has read the User Manual and its supplemental documentation, and that it is observed accordingly, especially the relative safety and warning instructions.
⇨ Chap. "1.4 Responsibilities", Page 4

1.1.1.2 Trained Staff

Target Group: Trained Staff

The trained staff must read the User Manual and its important supplemental documentation and must observe and follow the instructions, especially the respective safety and warning instructions.

1.1.2 Subject to Change and Validity

Subject to Change and Validity of the User Manual

The information in this User Manual is valid as of the date this version of the User Manual is released. Version number and release date of this User Manual are noted in the footer.
The User Manual at hand is subject to change at any time and such may be made without justification.

1.1.3 Completeness

Completeness of the User Manual

The User Manual is only complete along with the supplemental documentation relevant for each particular application.
⇨ Chap. "1.2 Supplemental Documentation", Page 2

1.1.4 Safe Keeping

Safe Keepingfor the User Manual

The User Manual at hand and any and all relevant supplemental documentation for each respective application must always be kept safely in an easily accessible location and be available at all times in the vicinity of the radial piston pump or close to the machinery the pump is assigned to.

1.1.5 Warning Labels

Warning Labels

DANGER

Denotes safety instructions, which are meant to warn of an imminent danger of death or serious bodily injury or of significant property damage.
Non-observance of these safety instructions will inevitably lead to death, serious injuries (crippling injuries) or significant damage to property!

WARNING

Denotes safety instructions, which are meant to warn of possible danger of death or serious bodily injury or of possible significant property damage.
Non-observance of these safety instructions may lead to death, serious injuries (crippling injuries) or significant damage to property!

CAUTION

Denotes safety instructions, which are meant to warn of the risk of slight injuries or minor property damage.
Non-observance of these safety instructions may lead to slight injuries or minor damage to property!

1.1.6 Symbols

Symbols

ⓘ	Denotes important instructions
• or -	Denotes lists
⇨	Denotes reference to another chapter, another page, table or figure in the User Manual as well as supplemental documentation
1., 2., …	Denotes steps in a process, which are to be carried out one after another

1.2 Supplemental Documentation

Supplemental Documentation

ⓘ The supplemental documentation listed here is an integral part of the scope of delivery.

Supplemental Documentation	Description
Order data sheet / bill of delivery	Includes item numbers, item names, quantities
User Manual RKP II Explosion-proof	ATEX supplemental instructions in the event that the radial piston pump is suitable for operation in explosive areas (if required, included in the scope of delivery)
Application Instruction RKP-D with CAN Bus Interface	User Manual for the radial piston pump with digital on-board electronics (if required, included in the scope of delivery)
Catalog Radial Piston Pump for fire-resistant fluids	Supplemental instructions for operation with fire-resistant fluids (if required, included in the scope of delivery)

Tab. 1: Supplemental Documentation

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1.3 Environmental Safety

1.3.1 Emissions

Environmental Safety: Emissions

If operated properly according to instructions, typically no dangerous emissions emanate from the radial piston pump.

1.3.2 Disposal

Environmental Safety: Disposal

When disposing of the radial piston pump, its spare parts or accessories, packaging material no longer needed, hydraulic fluid or additives and substances needed for cleaning purposes, the respective country-specific waste disposal regulations as amended must be observed!
In some cases, the items to be disposed of must be disassembled professionally and be separated according to their materials and then be disposed of in the respective waste stream or recycling location accordingly.

Incorporated in the radial piston pumps are, among other things, the following substances or materials:

- Electronic components ⇨ Application Instruction RKP-D with CAN Bus Interface
- Adhesive and potting compounds
- Parts with galvanized surfaces
- Hydraulic fluid
- Various metals and plastics

1.4 Responsibilities

Responsibility of the manufacturer and that of the operator of the machinery

The manufacturer and the operator of the machinery are both responsible to see that the planning and execution of the work performed with and to the radial piston pump as well as all interactions with the radial piston pump are carried out in accordance with the instructions given in this User Manual and in the relevant supplemental documentation for each respective application.
The manufacturer and the operator of the machinery are responsible in detail for the following:

- Staff selection and training
  ⇨ Chap. "2.2.2 Selecting and Qualifying Staff", Page 8
- Intended use
  ⇨ Chap. "2.1 Intended Use", Page 7
- Safe operation
  ⇨ Chap. "2.2.1 Safe Operation", Page 8
- Taking required work safety measures for the respective application and monitoring
  ⇨ Chap. "2.2.4 Work Safety", Page 9
- Observing the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- Observing the relevant regulations applicable nationally and internationally, as well as applicable standards and directives (such as, e. g., EU Machine Directive and the regulations by the Employer's Liability Association, TÜV or VDE) as amended in their current version when designing, assembling and operating the machinery with all of the installed components.
- Installing a suitable safety system for limiting the pressure in the hydraulic connections
  ⇨ Chap. "2.3.2.1 Safety Devices for Limiting Pressure", Page 10
- Using only radial piston pumps in technically flawless condition and safe for operation
- Preventing unauthorized structural modifications, repairs and maintenance work to be carried out or such that are unprofessionally performed.
  ⇨ Chap. "2.2.3 Structural Modifications", Page 9
  ⇨ Chap. "10 Spare Parts, Accessories, Repairs", Page 57
- Defining and adhering to application specific inspection and servicing instructions
- Adhering to all technical data during storage, transport, assembly, disassembly, connecting, start-up, configuring, operating, cleaning, repairing or performing any troubleshooting, especially the ambient conditions as well as to the data of the hydraulic fluid in use.
- Proper storage, transport, assembly, disassembly, connection, start-up, configuration, operation, cleaning, repairing, performing any troubleshooting or disposal
- Easily accessible and available safe keeping of the
- Manual as well as the relevant supplemental documentation for each respective application.
  ⇨ Chap. "1.1.4 Safe Keeping", Page 1
- This User Manual and the relevant supplemental documentation for each respective application are to be added to the User Manual of the machinery.

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1.5 Warranty and Liability

In principle, our general terms and conditions for delivery and payment apply. These shall be available to the buyer at the latest at the time the sales contract is completed.

Limits to Warranty and Liability

Among other things, warranty and liability claims are excluded for personal injury or property damage should they be the result of one or more of the following causes:

- Work performed with and to the radial piston pump or handling the radial piston pump by users not qualified for the job
  ⇨ Chap. "2.2.2 Selecting and Qualifying Staff", Page 8
- Use in violation with regulations
  ⇨ Chap. "2.1 Intended Use", Page 7
- Unsafe operation
  ⇨ Chap. "2.2.1 Safe Operation", Page 8
- Failing to take required work safety measures for the respective application
  ⇨ Chap. "2.2.4 Work Safety", Page 9
- Not adhering to the instructions in User Manual at hand or to the relevant supplemental documentation for the respective application
- Non-observance of the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- Non-observance of the relevant regulations applicable nationally and internationally, or standards and directives (such as, e. g., EU Machine Directive and the regulations by the Employer's Liability Association, TÜV or VDE) as amended in their current version when designing, assembling and operating the machinery with all of the installed components.
- Failure to install a suitable safety system for limiting the pressure in the hydraulic connections
  ⇨ Chap. "2.3.2.1 Safety Devices for Limiting Pressure", Page 10
- Using radial piston pumps that are not in technically flawless condition or not safe for operation
- Unauthorized or improperly performed modifications to the design or repairs and maintenance work
  ⇨ Chap. "2.2.3 Structural Modifications", Page 9
  ⇨ Chap. "8 Maintenance and Repairs", Page 53
- Not adhering to the inspection and maintenance instructions from the manufacturer and the operator of the machinery.
- Not adhering to all technical data during storage, transport, assembly, disassembly, connecting, start-up, configuring, operating, cleaning, repairing or resolving any possible failures, especially to the ambient conditions as well as to the data of the hydraulic fluid in use.
  ⇨ Chap. "4 Technical Data", Page 27
- Improper storage, transport, assembly, disassembly, connection, start-up, configuration, operation, cleaning, repairing, resolving any possible failures or disposal
- Use of unsuitable or defective accessories or rather unsuitable or defective spare parts
  ⇨ Chap. "10 Spare Parts, Accessories, Repairs", Page 57
- Catastrophic events beyond our control or acts of God

1.6 Manufacturer's Declaration and Declaration of Conformity

Manufacturer's Declaration and Declaration of Conformity

The declaration of conformity is of significance in the event the radial piston pump is utilized in an explosive area.
The manufacturer's declaration is of significance when the radial piston pump is utilized in a non-explosive area.
The radial piston pump RKP-II conforms to the standards listed in declaration of conformity and the manufacturer's declaration related to it.
The radial piston pump adheres to the requirements of the Machine Directive 98/37/EC. Radial piston pumps for use in explosive areas also adhere to the requirements of the EC Directive 94/9/EC (ATEX).
Information on the standards applied can be gathered from the relative Declaration of Conformity and the Manufacturer's Declaration.

ⓘ Declaration of Conformity and Manufacturer's Declaration
⇨ Chap. "12 Appendix", Page 61

1.7 Trademarks

Trademarks

Moog™ and Moog Authentic Repair Service™ are registered trademarks of Moog Inc. and its subsidiaries.

ⓘ All product and company names listed in the User Manual are possibly protected trademarks of their respective manufacturer, the use of which by third parties for their own purposes may be in violation of the manufacturer's rights.
A missing ® or ™ symbol may not be interpreted to mean that the name is a brand name that can be used unrestricted.

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2 Safety

2.1 Intended Use

Intended Use

The Radial Piston Pump RKP-II is a work machine used to produce hydraulic displacement. Certain versions of the radial piston pumps are fitted with an additional safety function for locking (not a hermetic sealing function) the hydraulic displacement.

Use Environment:

The radial piston pump is designed to control and regulate pressures and displacements in commercial applications.

Obvious Misuse:

Operating the unit outside of the specifically defined application and environmental conditions
in relationship to:

- Operating pressure
- Temperature
- Speed and rotational direction
- Operational environmental pressure
- Shock / vibration
- Electromagnetic interference resistance
- Operating fluids (viscosity, cleanliness class, chemical ingredients)
- Protection class
- Electrical and electromagnetic connections
- Operation in explosion hazardous areas if not permitted for such use

For incorporating into superordinate levels of machinery, the following applies:

- The Radial Piston Pump is only to be operated as a component for a complete superordinate system, e. g. in a machinery set up.
- The Radial Piston Pump is designed to be used with the specified operating fluid. Use with any other operating fluid requires our express approval.
- The efficient, reliable and safe operation of the Radial Piston Pump requires quality project planning as well as professional execution, transport, storage, mounting, demounting, electrical and hydraulic connections, start-up, configuration, operation, cleaning and servicing.

The Radial Piston Pump may not be put into operation until the following has been assured:

- The superordinate level machinery with all of its installed components adheres to the relevant, nationally and internationally applicable regulations, standards and directives (such as the EU Machine Directive and the applicable regulations by the Employer's Liability Insurance Association, TÜV or VDE) as amended.
- The Radial Piston Pump and all other installed components are in technically sound and fail-safe condition.

For its intended use, the following applies:

- Observance of the User Manual
- Handling the Radial Piston Pump safely
  ⇨ Chap. "2.2.1 Safe Operation", Page 8
- Adhering to the inspection and maintenance instructions from the manufacturer and the operator of the machinery.
- Following all of the corresponding relevant supplemental documentation in accordance with the application
- Observing the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- Observing the relevant regulations applicable nationally and internationally, as well as applicable standards and directives (such as, e. g., the EU Machine Directive and the applicable regulations by the Employer's Liability Insurance Association, TÜV or VDE) as amended.

2.2 Organizational Measures

2.2.1 Safe Operation

ⓘ It is the responsibility of the manufacturer and the operator of the machinery to ensure safe operation of the Radial Piston Pump.

Safe Operation

The basic requirement for safe handling and trouble free operation involves observing the following:

- All relevant safety instructions and user manuals
- All safety instructions or the relevant supplemental documentation for the respective application
- All safety instructions pertaining to the relevant manufacturer's safety standards and those of the operator of the machinery for each respective application
- All relevant nationally and internationally applicable safety and accident prevention regulations, standards and directives, such as the safety instructions of the Employer's Liability Insurance Association, TÜV or VDE, in particular the following standards for the safe operation of machines:
  - DIN EN ISO 12100
  - DIN EN 982

Following the safety instructions and the safety and accident prevention regulations, standards and directives helps to prevent accidents, machine failure and property damage!

2.2.2 Selecting and Qualifying Staff

Selecting and Qualifying Staff

WARNING

Incorrect handling of the Radial Piston Pump!
May lead to severe personal injury and property damage.

- Any and all work to the Radial Piston Pump may only be performed by user's qualified to do so and those authorized.

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Qualified Users

Qualified users are skilled professionals, who have been trained to carry out these tasks and who have the required knowledge and experience. In particular, such skilled professionals must be licensed to operate, ground and label machines, systems and electric circuits in accordance with applicable safety standards. Project planners must be familiar with the safety concepts for automated technology.

2.2.3 Structural Modifications

Structural Modifications

In order to prevent damage to the Radial Piston Pump or to any of its accessories, structural modifications to the equipment may only be performed by us or by an authorized service location.
⇨ Chap. "8.3 Moog Service Addresses", Page 54

Among other things, warranty and liability claims shall be excluded for personal injury or property damage, if they are the result of unauthorized or improperly carried out structural modifications or tampering with the equipment in any other way.
⇨ Chap. "1.5 Warranty and Liability", Page 5

2.2.4 Work Safety

Work Safety

WARNING

Danger! Magnetic Fields!
Certain components in an equipment system may be the cause of magnetic field and cause interference to sensitive devices.

- Maintain the respective device-related safety clearance.

CAUTION

Danger! Toppling Objects!
Toppling tools and accessories may lead to bodily injury.

- Wear suitable protective work equipment such as, e. g., safety shoes.

CAUTION

Risk of Burns!
The Radial Piston Pump and the hydraulic connection lines may get very hot during operation and may lead to burns on skin contact.

- Wear suitable protective work equipment such as, e. g., work gloves.

CAUTION

Noise Exposure!
When operating the machinery, the operator may be exposed to loud noise, which can lead to hearing damage.

- The operator / manufacturer must take suitable measures to protect against noise, such as, for example, instructing the use of ear protection.

CAUTION

Hazardous Operating Fluid!
When exposed to hazardous operating fluid, skin contact or inhaling may lead to bodily injury.

- Wear suitable protective work equipment such as, e. g., work gloves.

2.3 General Safety Instructions

General Safety Instructions

- Any and all work to the Radial Piston Pump may only be performed by user's qualified to do so and those authorized.
  ⇨ Chap. "2.2.2 Selecting and Qualifying Staff", Page 8
- The technical data and especially the information shown on the Radial Piston Pump's nameplate are to be observed and adhered to.
  ⇨ Chap. "4 Technical Data", Page 27

2.3.1 Specific Phases of Operation

General Safety Instructions for specific phases of operation

2.3.1.1 Mounting

- During mounting, make sure that all connections, plugs and sockets are tightly sealed to prevent substances from penetrating into the Radial Piston Pump.
- The Radial Piston Pump must be completely filled with operating fluid.
- Before mounting, the Radial Piston Pump must have adjusted to room temperature and it may not contain any condensation.

2.3.1.2 Start Up

- All hydraulic and electric connections must be in use or closed off.
- Never put the Radial Piston Pump into operation until after all mounting steps have been completed.

2.3.1.3 Maintenance and Repairs

- Maintenance and repair work as well as servicing work is to be carried out according to schedule and to the regularly specified times.
- Secure the machinery from being started up during maintenance and repair.
- Make sure the machinery is not under pressure during maintenance work.

2.3.2 Operating Hydraulic Equipment

General Safety Instructions when operating hydraulic equipment

2.3.2.1 Safety Devices for Limiting Pressure

DANGER

Risk of injury and property damage as a result of excess pressure!
Excess pressure in the machinery may damage parts of the machine and as a result may lead to severe injuries.

- In order to limit the machinery to the maximum permissible operating pressure, it is crucial to install a pressure limitation valve directly at the pump output line.

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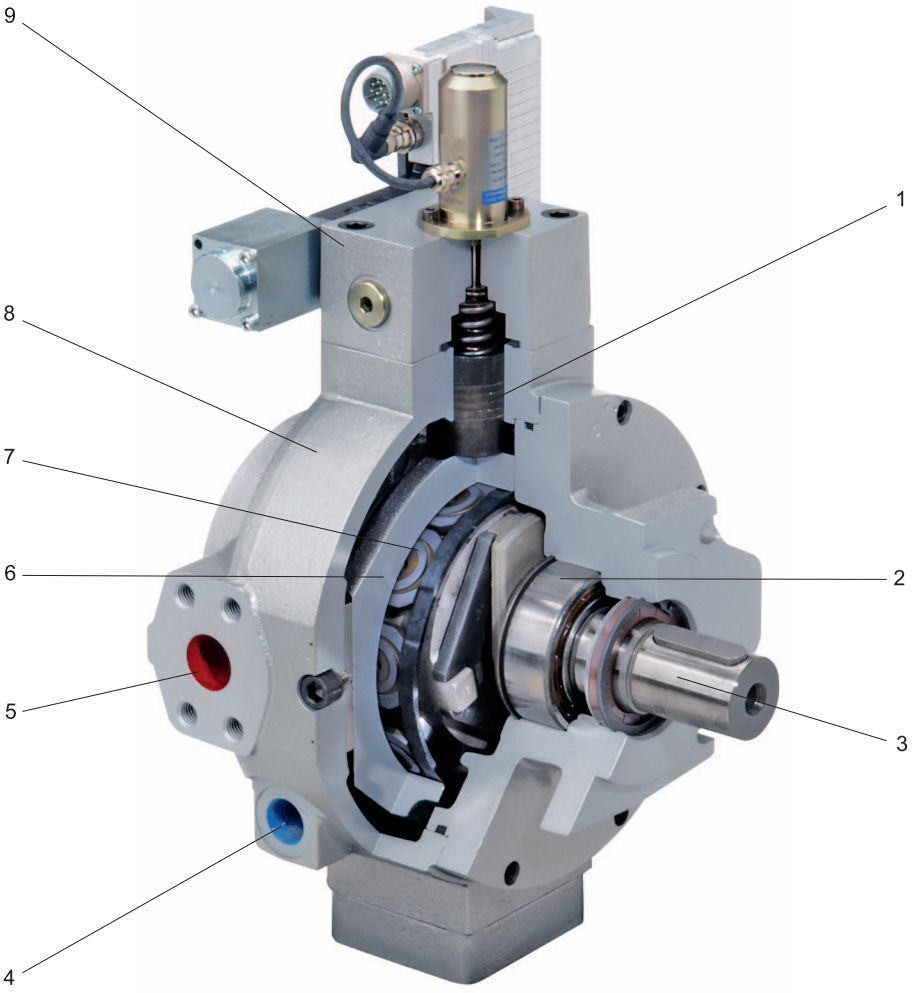
3 Product Description

3.1 Configuration

Configuration

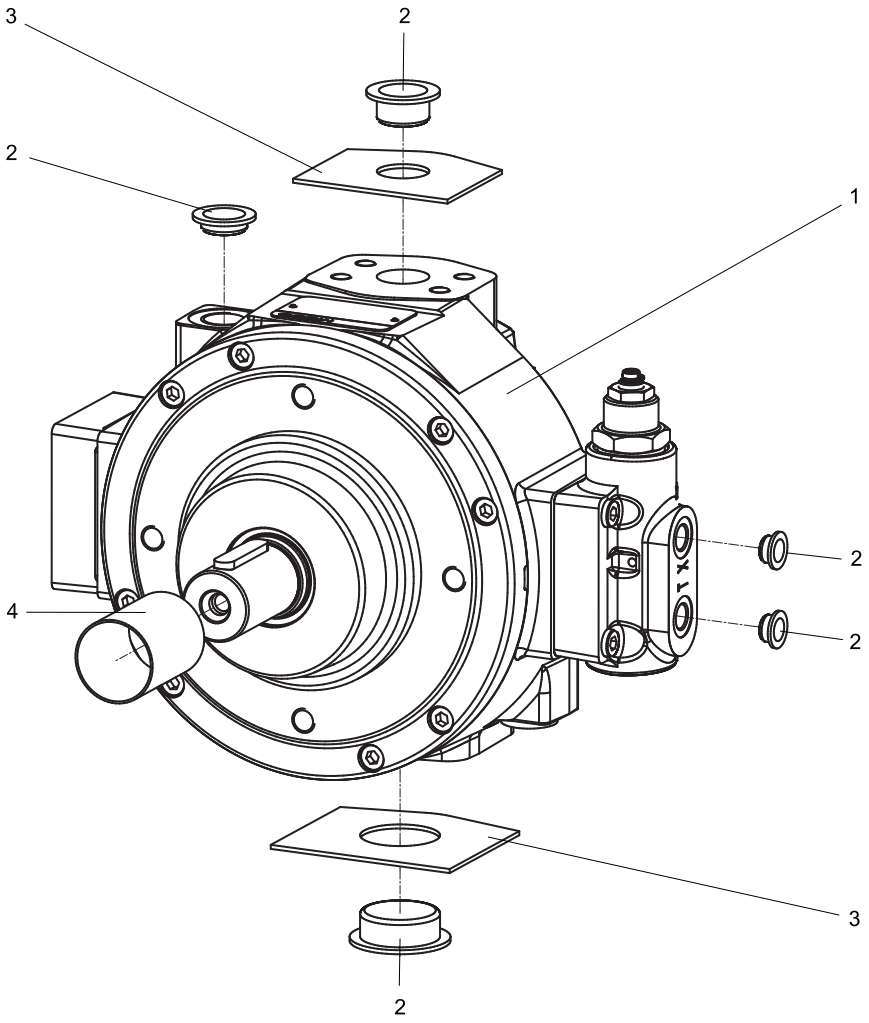


Pos.	Description
1	Control piston
2	Rolling bearing
3	Drive shaft
4	Drain Port
5	SAE piping connection
6	Sliding stroke ring
7	Slipper pad with working piston
8	Housing
9	Compensator

Fig. 1: Configuration Radial Piston Pump RKP-II

3.2 Scope of Delivery

Scope of Delivery



Pos.	Description
1	Radial Piston Pump RKP-II
2	Cap
3	Flange cover
4	Transport protection for shaft ends

Fig. 2: Scope of Delivery

When pump stages are delivered, the through-drive is closed with a cap. The caps are not suitable for operational purposes.

Included in the scope of delivery:

- Radial piston pump RKP-II with flange covers, caps and transport protection for the shaft ends, preserved
- User manual with additional documentation

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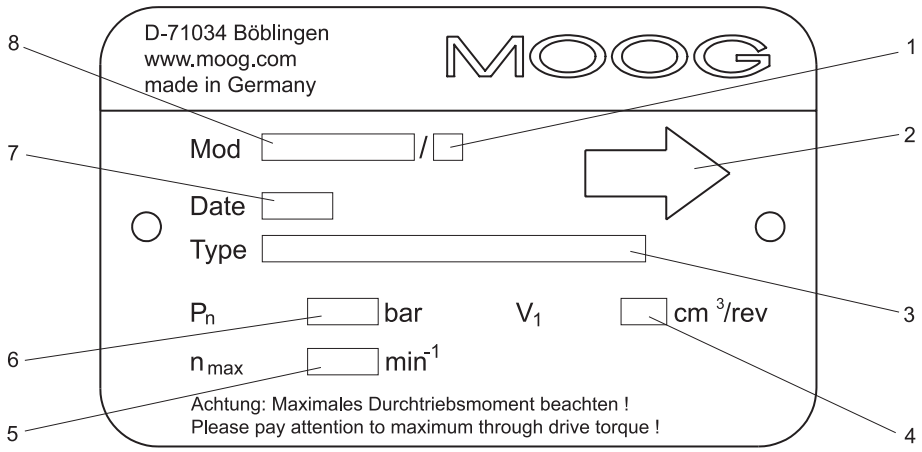
3.3 Nameplate

Nameplate



Pos.	Marking	Additional Information
1	Revision status	
2	Rotation direction	
3	Type key	⇨ Catalog Radial Piston Pump RKP-II
4	displacement	
5	Maximum revolutions for low noise operation	
6	Maximum operating pressure	
7	Date of manufacture in the format MM/YY	
8	Model number	

Fig. 3: Nameplate for Radial Piston Pump RKP-II

ⓘ In the case of multiple pumps, each individual pump has its own nameplate.

3.4 Functional Description

Functional Description

The shaft (Pos. 11) transfers the drive torque to the star-shaped cylinder block (Pos. 7), free of any axial forces, via a crossdisc coupling (Pos. 10). The cylinder block is hydrostatically supported on the control journal (Pos. 6). The radial pistons (Pos. 5) in the cylinder block run against the stroke ring (Pos. 3) through hydrostatically balanced slipper pads (Pos. 4). The pistons and slipper pads are joined by ball and socket joints and locking rings. The slipper pads are guided in the stroke ring by two retaining rings (Pos. 2) and, when running, are held against the stroke ring by centrifugal force and oil pressure.
As the cylinder block rotates, the pistons reciprocate due to the eccentric positioning of the stroke ring, the piston stroke being twice the eccentricity. The eccentric position of the stroke ring is controlled by two diametrically opposed control pistons (Pos. 1, Pos. 8) and the pressure compensator (Pos. 9).
The oil flow to and from the pump passes through the pump ports and into and out of the pistons through the porting in the control journal. The bearing supporting the drive shaft is only subjected to external forces. The compensator setting limits the system pressure and adjusts the pump flow between zero and full flow to maintain the set pressure.

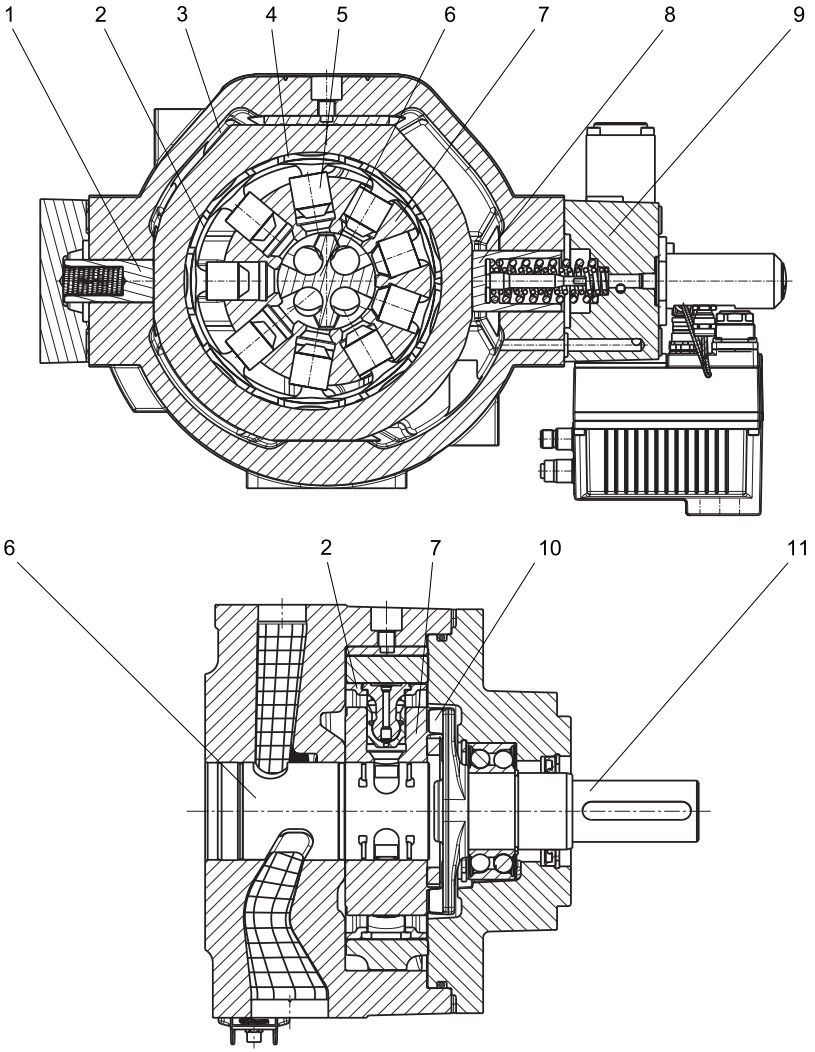


Fig. 4: Cross Section Radial Piston Pump RKP-II

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3.5 Compensator Operation

Compensator Operation

The Radial Piston Pump RKP-II enables a variety of compensator options to be used. This ensures maximum flexibility.

The following options are described in more detail later on:

No.	Compensator Option	Description/Characteristics/Application
1	**Adjustable pressure compensator, F1, F2**	For constant pressure systems with a fixed pressure settings ⇨ Chap. "3.5.1 Adjustable Pressure Compensator, F1, F2", Page 16
2	**Remote Pressure Compensator, H1**	For constant or variable pressure systems with remote pressure setting ⇨ Chap. "3.5.2 Hydraulically Driven Remote Pressure Compensator, H1", Page 17
3	**Remote Pressure Compensator with Mooring-Control, H2** hydraulically adjustable	For constant pressure systems with variable pressure setting for mooring control ⇨ Chap. "3.5.3 Remote Pressure Compensator with Mooring Control, H2", Page 18
4	**Load sensing compensator, J1** Combined pressure and flow compensator	For displacement systems with variable volume flow and loadsensing pressure control (hydro-mechanical compensator concept) ⇨ Chap. "3.5.4 Load Sensing Compensator, J1", Page 19
5	**Load sensing compensator with p-T control notch, R1** Combined pressure and flow compensator with p-T control notch	As described in 4 plus: active reduction of pressure peaks during dynamic control processes ⇨ Chap. "3.5.5 Load Sensing Compensator with p-T Control Notch, R1", Page 20
6	**Mechanical stroke adjustment, B1**	For displacement systems with fixed flow volume settings, which can be changed manually if needed ⇨ Chap. "3.5.6 Mechanical Stroke Adjustment, B1", Page 21
7	**Servo control, C1**	The Pump displacement can be adjusted with a hand lever or an actuator ⇨ Chap. "3.5.7 Servo Control, C1", Page 22
8	**Constant Horsepower Control, S1** (force comparison system)	Automatic reduction of displacement in the event of an increasing load so that the capacity of the drive motor is not exceeded ⇨ Chap. "3.5.8 Power Control, S1", Page 23
9	**Remote Constant Horsepower Control, S2** wtih pressure and flow limiter, with superimposed pressure and displacement limitation, controlled hydraulically	As described in 8 plus: an adjustable maximum limit setting for pressure and displacement ⇨ Chap. "3.5.9 Power Control, S2", Page 25
	RKP-D	Radial piston pump with digital on-board electronics ⇨ Application Instruction RKP-D with CAN Bus Interface

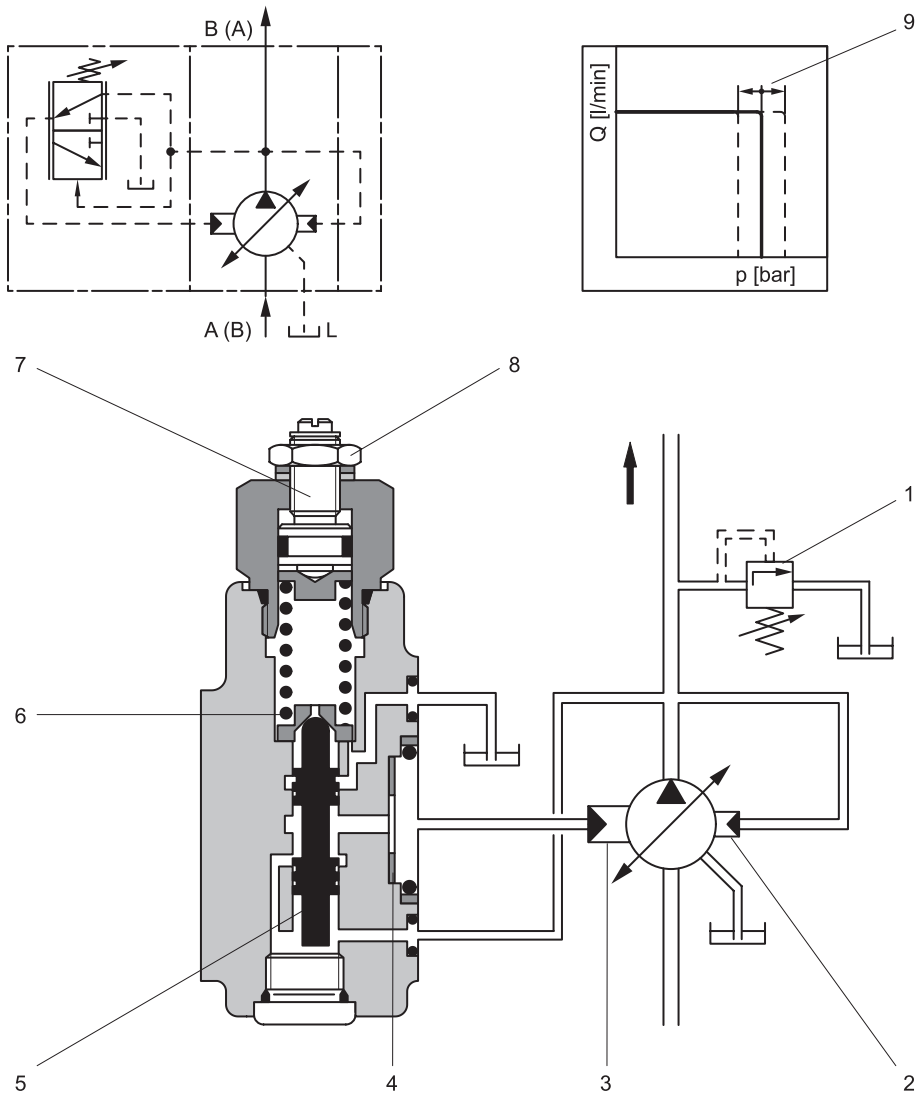
Tab. 2: Description of the Compensator Options

ⓘ All compensators are pre-set at the factory.
Information on setting the compensators:
⇨ Chap. "7.1.2 Adjusting the Compensator", Page 44

3.5.1 Adjustable Pressure Compensator, F1, F2

Adjustable Pressure Compensator, F1, F2

Pressure range:
F1: 30–150 bar
F2: 80–350 bar



Pos.	Description
1	Safety valve p = $p_{max.}$ + 30 bar
2	Control piston 2
3	Control piston 1
4	Adjustment of zero stroke
5	Valve spool
6	Valve spring
7	Adjustment screw
8	Locknut for the adjustment screw
9	Setting the adjustment screw

Fig. 5: Adjustable pressure compensator, F1, F2

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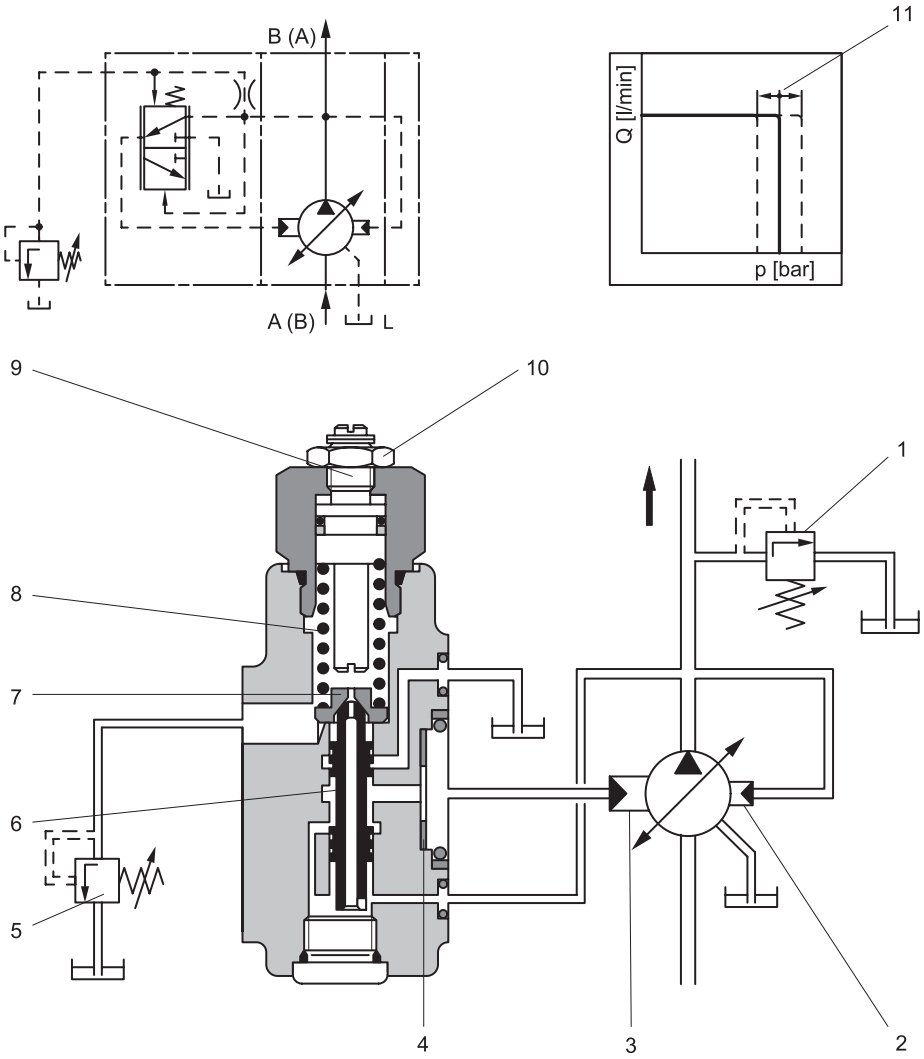
3.5.2 Hydraulically Driven Remote Pressure Compensator, H1

Pressure pilot valve:
Manually adjustable or proportional pressure valve Q = 1–1.5 l/min.

Hydraulically Driven Remote Pressure Compensator, H1



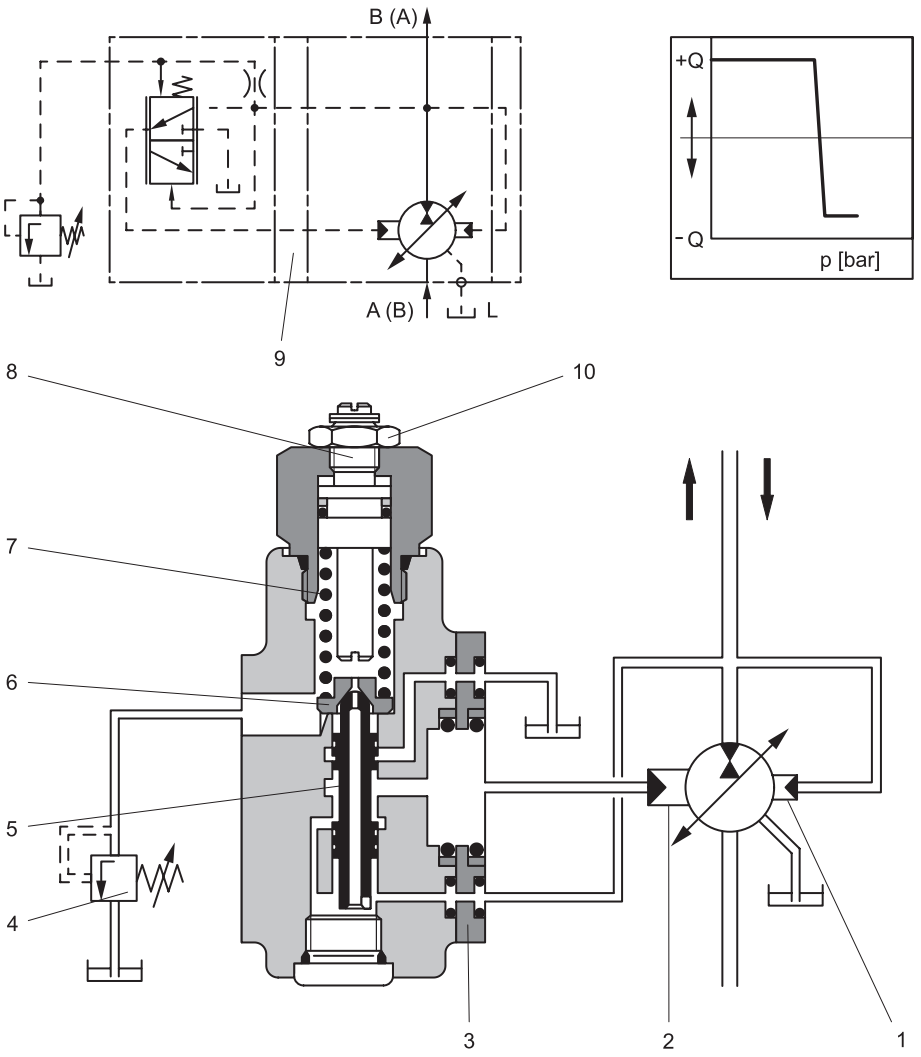
Pos.	**Description**
1	Safety valve p = $p_{max.}$ + 30 bar
2	Control piston 2
3	Control piston 1
4	Adjustment of zero stroke
5	Pilot pressure valve
6	Valve spool
7	Orifice
8	$p_{min.}$ spring
9	Locked adjustment screw
10	Locknut for the adjustment screw
11	Set a pilot valve

Fig. 6: Hydraulically Driven Remote Pressure Compensator, H1

3.5.3 Remote Pressure Compensator with Mooring Control, H2

Remote Pressure Compensator with Mooring Control, H2

The pressure compensator with Mooring control has an intermediate plate inserted between the pump body and the pressure compensator. The intermediate plate enables the pump's absorption operation.



Pos.	Description
1	Control piston 2
2	Control piston 1
3	Intermediate plate
4	Pilot pressure valve:
5	Valve spool
6	Orifice
7	$p_{min.}$ spring
8	Locked adjustment screw
9	Intermediate plate
10	Locknut for the adjustment screw

Fig. 7: Pressure Compensator with Mooring Control, H2

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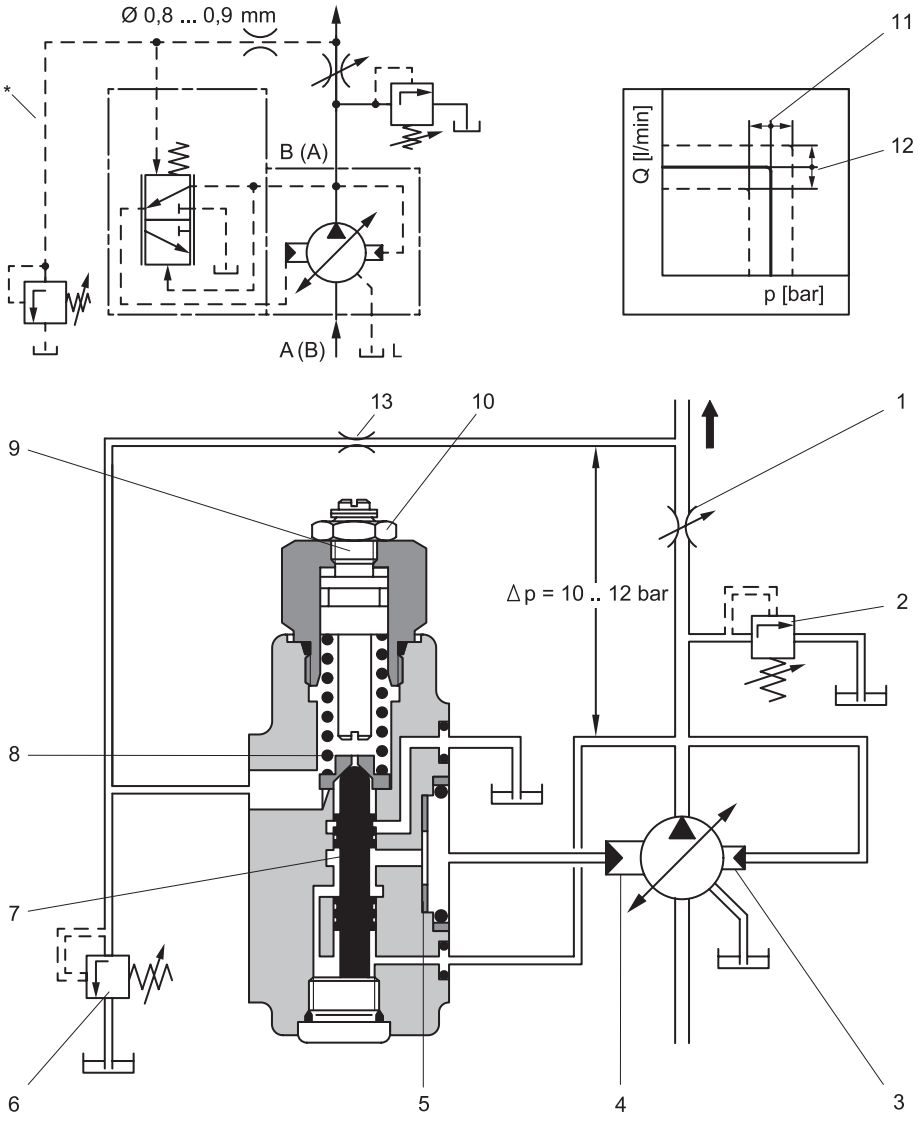
3.5.4 Load Sensing Compensator, J1

Load Sensing Compensator, J1

Metering orifice:
Manually remote adjustable orifice valve or proportional orifice valve.

Pressure pilot valve:
Manually remote adjustable proportional pressure valve Q = 1–1.5 l/min.



Pos.	Description	Pos.	Description
1	Metering orifice for flow control	8	Δp spring
2	Safety valve p = $p_{max.}$ + 30 bar	9	Locked adjustement screw
3	Control piston 2	10	Locknut for the adjustment screw
4	Control piston 1	11	Set at pilot valve
5	Adjustment of zero stroke	12	Set at metering throttle
6	Pilot pressure valve:	13	Orifice Ø 0.8 ... 0.9 mm
7	Valve spool		

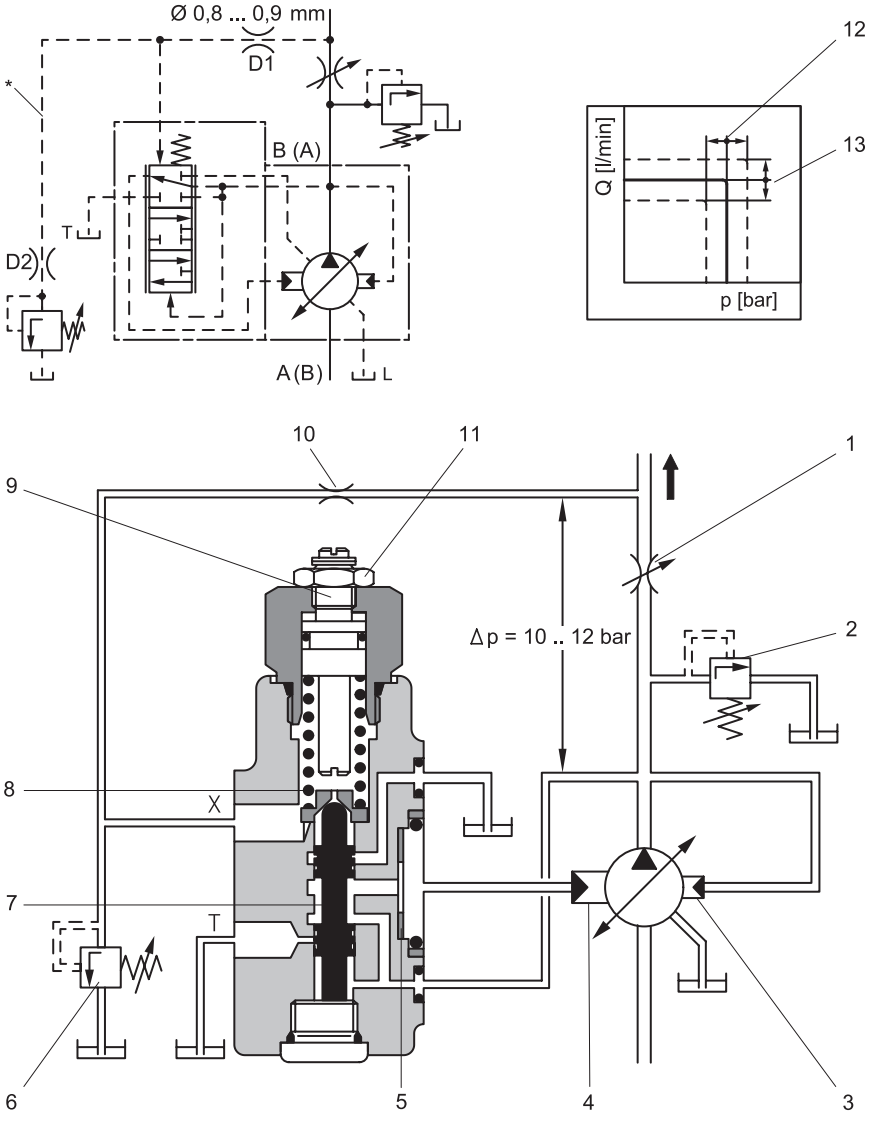
Fig. 8: Load sensing compensator, J1

3.5.5 Load Sensing Compensator with p-T Control Notch, R1

Load Sensing Compensator with p-T Control Notch, R1

Metering orifice:
Manually remote adjustable orifice valve or proportional orifice valve.

Pressure pilot valve:
Manually remote adjustable proportional pressure valve Q = 1–1.5 l/min.
For multiple pumps feeding in one common line, only one compensator with a p-T control notch may be used. This compensator must be set to the higher ∆p value.



Pos.	Description	Pos.	Description
1	Metering orifice for flow control	8	∆p spring
2	Safety valve p = $p_{max.}$ + 30 bar	9	Locked adjustment screw
3	Control piston 2	10	Orifice Ø 0.8 ... 0.9mm
4	Control piston 1	11	Locknut for the adjustment screw
5	Adjustment of zero stroke	12	Set at pilot valve
6	Pilot pressure valve:	13	Set at metering throttle
7	Valve spool		

Fig. 9: Load Sensing Compensator with p-T Control Notch, R1

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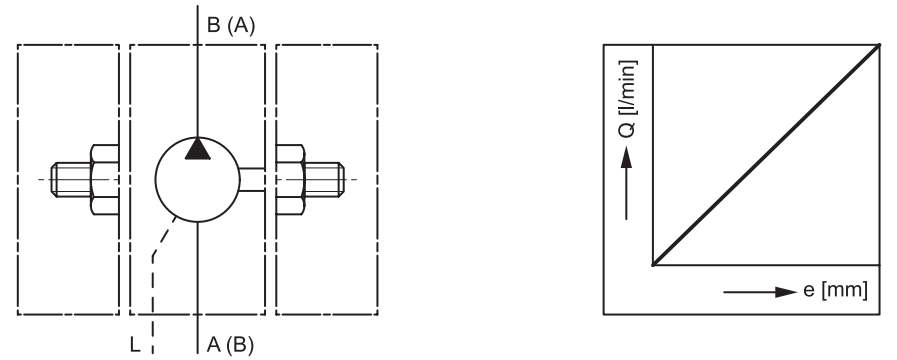
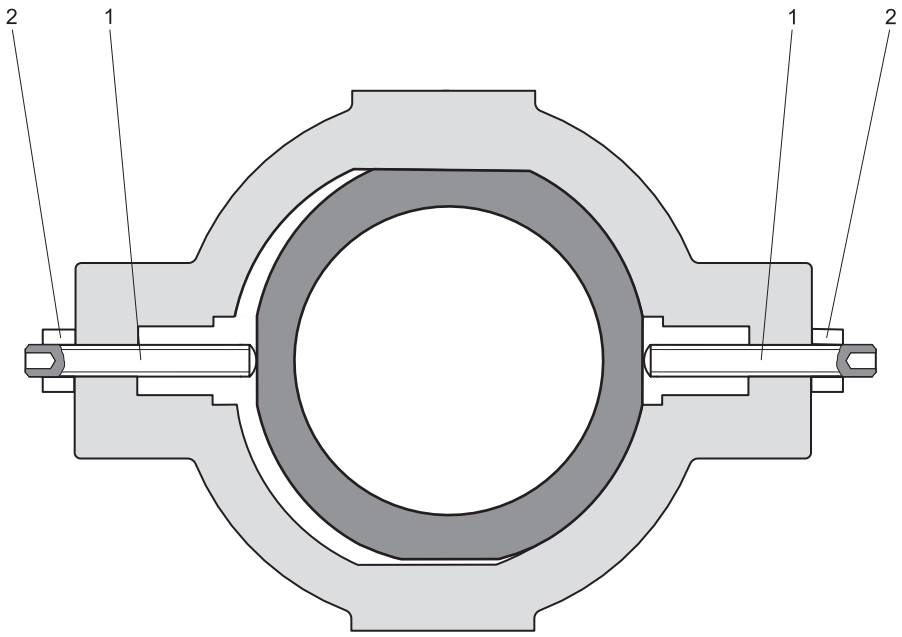
3.5.6 Mechanical Stroke Adjustment, B1

Mechanical Stroke Adjustment, B1



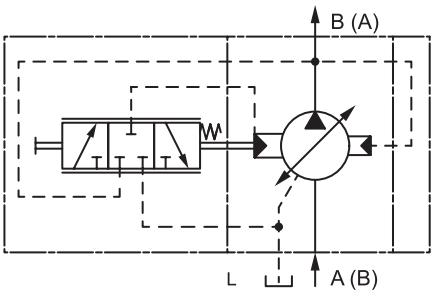


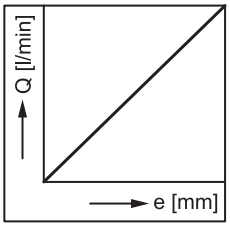
Pos.	Description
1	Adjustment screw
2	Seal nut

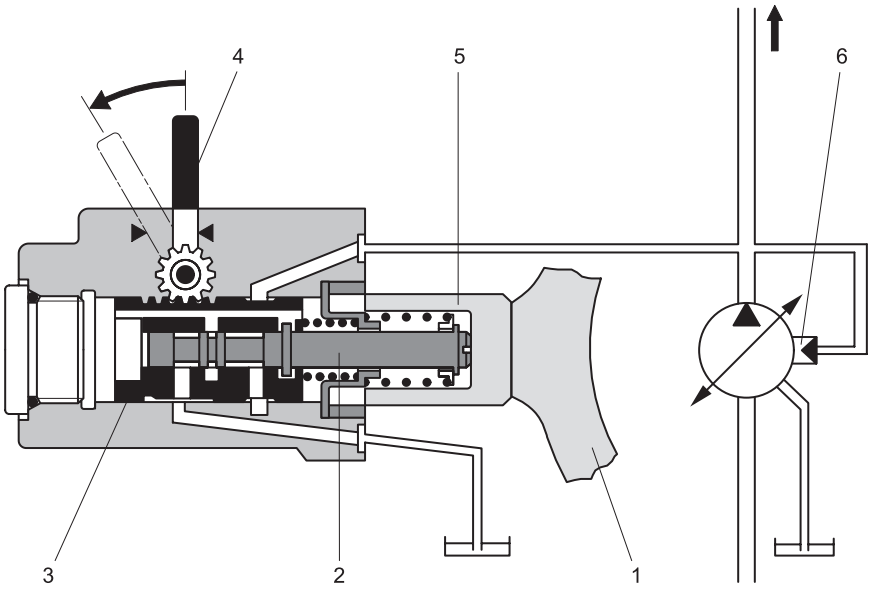
Fig. 10: Mechanical stroke adjustment, B1

3.5.7 Servo Control, C1

Servo Control, C1







Pos.	**Description**	**Pos.**	**Description**
1	Stroke ring	4	Adjustment lever for control shaft
2	Pilot spool	5	Control piston 1
3	Spool sleeve	6	Control piston 2

Fig. 11: Servo control, C1

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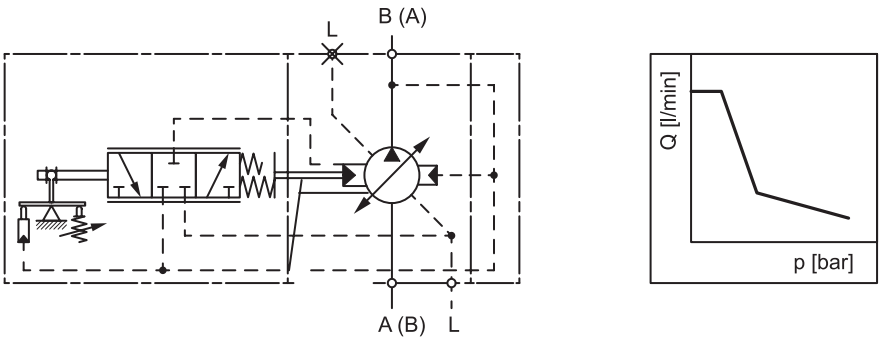
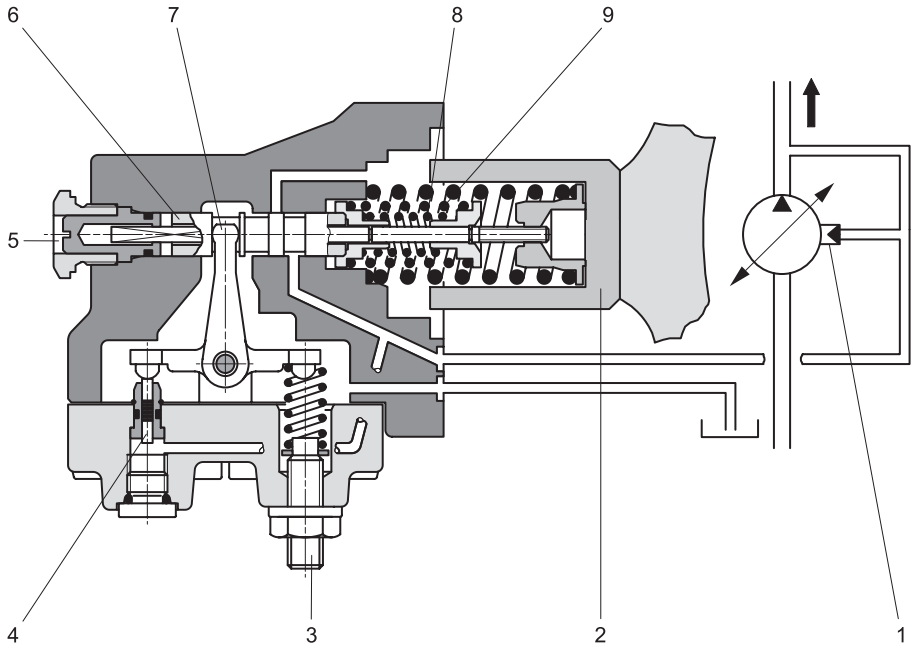
3.5.8 Power Control, S1

Power Control, S1





Pos.	Description	Pos.	Description
1	Control piston 2	6	Pilot spool
2	Control piston 1	7	Rocker
3	Adjustment screw (**fixed setting, do not modify**)	8	Spring 1
4	Sensing piston	9	Spring 2
5	Adjusting screw (**fixed setting, do not modify**)		

Fig. 12: Power control, S1

Characteristics for Power Control, S1

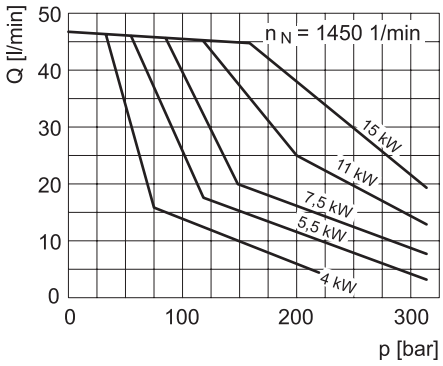


Fig. 13: Characteristic V = 32 cm^3/U

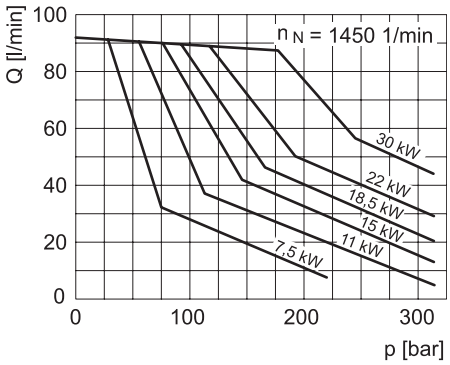


Fig. 14: Characteristic V = 63 cm^3/U

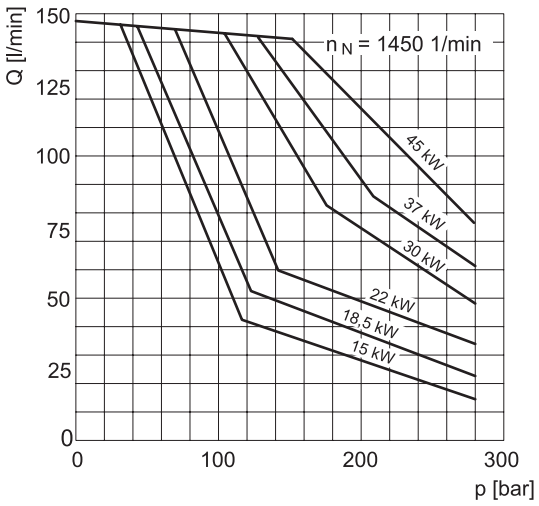


Fig. 15: Characteristic V = 100 cm^3/U

Approximation to the power hyperbola by means of two springs. Referenced on n = 1450 1/min.

For other revolutions, the following applies:

$$P = \frac{P_N \cdot n}{1450}$$

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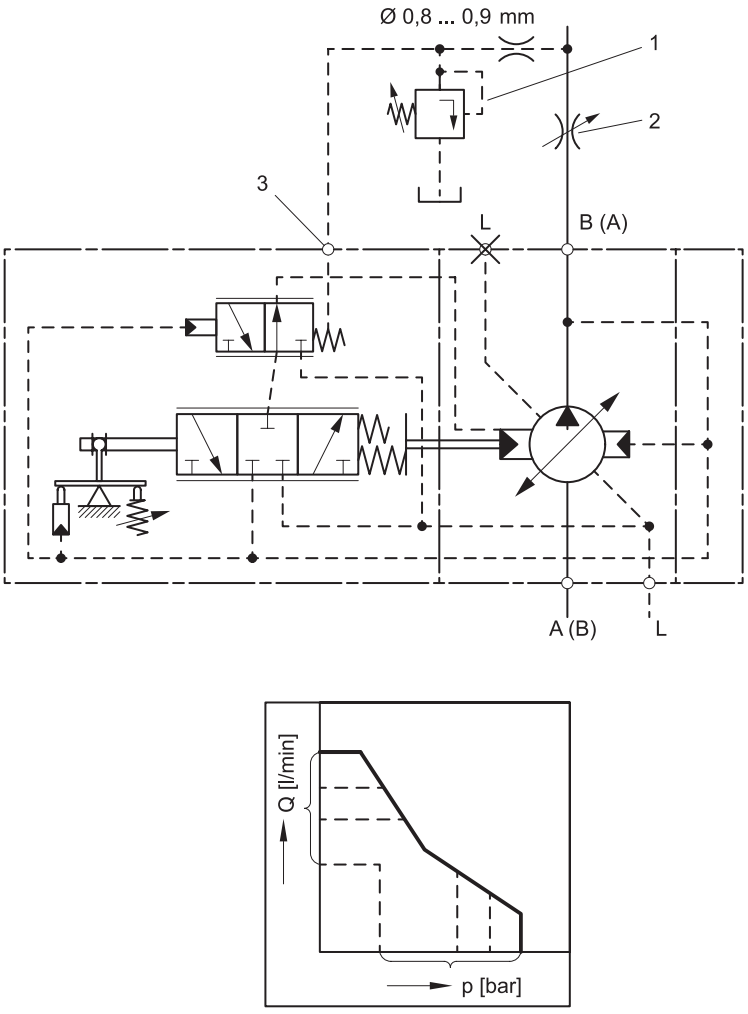
3.5.9 Power Control, S2

Hydraulically operated power control with superimposed pressure and displacement limitation

Power Control, S2



Pos.	Description
1	Pressure p setting
2	Flow control Q setting
3	Control port

Fig. 16: Power control, S2

For your notes.

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4 Technical Data

4.1 General Technical Data

General Technical Data

Displacement [cm^3/R]	**19**	**32**	**45**	**63**	**80**	**100**	**140**
Type of construction	Radial Piston Pump for open circuits with various control devices						
Type of mounting	End mounting, centering and hole-circle diameter as per DIN/ISO 3019/2 (metric) Attachment flange as per DIN/ISO 3019/1 (dimensions in inches) Attachment flange as per DIN/ISO 3019/2 (metric)						
Mounting position	optional						
Weight [kg]	22	33	33	71	71	71	103
Mass moment of inertia [kg/cm^2]	17.7	61	61	186.3	186.3	186.3	380
Line connections							
Pressure port							
Medium pressure version	3/4" 3000 psi	1" 3000 psi	1" 3000 psi	1 1/4" 3000 psi	1 1/4" 3000 psi	1 1/4" 6000 psi	1 1/2" 6000 psi
High-pressure version	3/4" 6000 psi	1" 6000 psi	–	1 1/4" 6000 psi	1 1/4" 6000 psi	–	–
Suction port							
Medium pressure version	3/4" 3000 psi	1 1/2" 3000 psi	1 1/2" 3000 psi	2" 3000 psi	2" 3000 psi	2" 3000 psi	2 1/2" 3000 psi
High-pressure version	3/4" 6000 psi	1 1/2" 3000 psi	–	2" 3000 psi	2" 3000 psi	–	–
Recommended pipe OD Drain pipes (lightweight version) [mm]	15 (5/8")	18 (3/4")	18 (3/4")	22 (7/8")	22 (7/8")	22 (7/8")	22 (7/8")

Tab. 3: General Technical Data

4.2 Operating Conditions

Operating Conditions

Displacement [cm³/R]	19	32	45	63	80	100	140
Drive type	Direct drive with coupling (for other drive types, please contact us)						
Ambient temperature range	-15 °C up to 60 °C						
Max. speed at inlet pressure 0.8 bar abs. [min⁻¹]	2700	2500	1800	2100	1500	1500	1500
Max. speed for inlet pressure 1 bar abs. [min⁻¹]	2900	2900	2100	2300	1800	1800	1800
Max. speed for low noise operation [min⁻¹]	1800	1800	1800	1800	1800	1800	1800
Min. inlet pressure suction port	0.8 bar absolute at pump inlet						
Max. housing pressure	2 bar (1 bar above atmosphere)						
Standard version: Continuous pressure [bar] Maximum pressure[1] [bar] Peak pressure [bar]	 280 315 350	 280 315 350	 280 315 350	 280 315 350	 280 315 350	 280 315 350	 280 315 350
High-pressure version: Continuous pressure [bar] Max. pressure[1] [bar] Peak pressure [bar]	 350 385 420	 350 385 420	 – – –	 350 385 420	 350 385 420	 – – –	 – – –
Hydraulic fluid	Mineral oil as per DIN 51 524						
Hydraulic fluid temperature range	-15 °C up to 80 °C						
Viscosity	Permissible operating range 12 up to 100 mm²/s Recommended operating range 16 up to 46 mm²/s Hydraulic fluid for viscosity class ISO VG 46 or VG 32 Max. viscosity 500 mm²/s during start-up using electric motor 1800 min⁻¹						
Filtering	NAS 1638, Class 9; ISO/DIN 4406, Class 20/18/15 Achievable using filter fineness $\beta_{20} = 75$[2]						

Tab. 4: Operating Conditions

[1] Maximum pressure as per DIN 24312

[2] Dirt particle retention rate > 20 µm is 1:75, meaning 98.67 %

ⓘ For special fluids, such as, e.g., HFA, HFC and emulsions, in part other values apply with regard to pressure, viscosity, temperature and filtering. Information on these values can be found in the following supplemental documentation:
⇨Catalog Radial Piston Pump for fire-resistant Fluids

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5 Transport and Storage

Transport and Storage

For pumps in explosive areas, observe the supplementary documentation as well:
⇨ User Manual RKP II Explosion-Proof

For any and all tasks to be performed on the pumps, appropriate personal protective equipment should be worn.
⇨ Chap. "2.2.4 Work Safety", Page 9

5.1 Unpacking the Pump

Unpacking the Pump

CAUTION

Individual parts may fall out!
If the original packaging is opened improperly, individual parts may fall out and be damaged or lead to injuries of a worker.

- Place the pump in its original packaging on a stable surface.
- Only open the original packaging from the top.
- Dispose of the packaging material in accordance with locally applicable regulations.

Procedure:

1. Remove original packaging.
2. Inspect product and contents according to the purchase order.
3. Check that the packing slip and delivered product match.
4. In the event of transport damage or defects, inform the manufacturer or the supplier.
5. Store original packaging for later use or dispose of it in accordance with locally applicable regulations.

5.2 Transporting the Pump

Transporting the Pump

DANGER

Risk of crushing!
The pump may topple over during transport and lead to crushing injuries.

- Select lifting tackle to correspond with the overall weight of the pump.
- Attach the lifting tackle to the pump properly.
- Avoid all areas below the floating load.

CAUTION

Damage to the drive shaft!
During transport, impact and blows to the drive shaft may damage the pump.

- Do not bang objects against the drive shaft.
- Do not place or set objects onto the drive shaft.
- Do not exceed permissible axial and radial forces to the drive shaft.

CAUTION

Damage to the attached parts!
Any heavy weight on the attached parts, for example the compensator, during transport may result in damage to such.

- Do not attach lifting tackle to the attached parts during transport.
- Make sure that the attached parts do not collide with other objects during transport.

For multiple pumps, add up the weights of the individual pumps.

Procedure:

1. Determine the weight and the dimensions of the pump.
   ⇨ Catalog Radial Piston Pump RKP-II
   ⇨ Chap. "4 Technical Data", Page 27
2. Attach suitable lifting tackle to the pump.
   - Mount the ring bolts into the attachment flange of the pressure side.
   - If the center of gravity is off-center (e. g. for multiple pumps with pump stages of the same weight): Attach the ring bolts to the exterior pumps.
3. Lift the pump carefully and transport it with supervision.

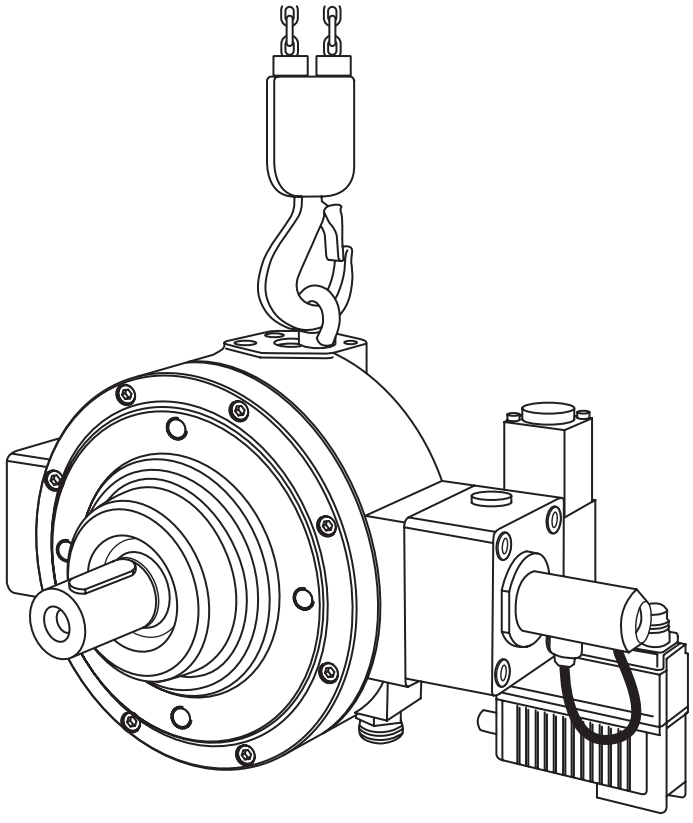

Fig. 17: Transporting Pump with Lifting Tackle

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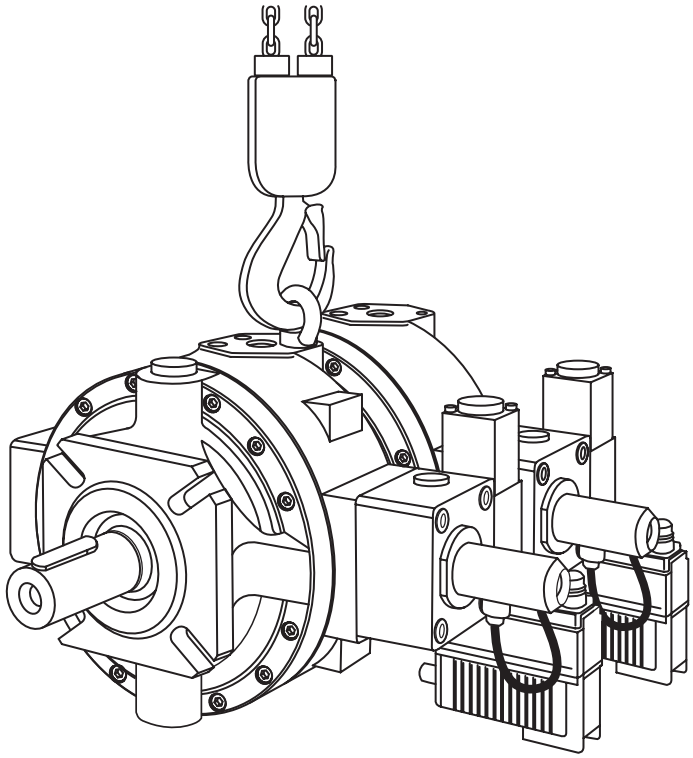

Fig. 18: Transporting Multiple Pumps with Lifting Tackle

5.3 Storing the Pump

CAUTION

Damage to Property! **Storing the Pump**

Storing the pump improperly may lead to property damage.

- Store the pump as instructed and if necessary, preserve it.

Preservation Conditions

Storage Duration	Preservation
up to twelve months	not required
> 1 year	required ⇨ Chap. "5.4 Preserving the Pump", Page 32

Tab. 5: Preservation Conditions

Storage Conditions

Storage Duration	Measures
> 1 year	Visual inspection

Tab. 6: Storage Conditions

Pre-Conditions:

- Pump has been demounted. ⇨ Chap. "9.1 Demounting the Pump", Page 55

Procedure:

1. Inspect to assure that all openings have been closed using flange covers or caps.
2. Check to assure that transportation protection means are attached to the pump's drive shaft.
3. Make certain that the storage space
   - Is clean, dry, frost-protected and free of corrosives and vapors.
   - Has a consistent temperature (temperature difference < 10 °C).
4. Depending on storage duration: preserve the pump
   ⇨ Tab. 5, Page 31
5. Check the storage conditions
   ⇨ Tab. 6, Page 31
6. After delivery: No steps need to be taken.
7. After demounting: Pour a small amount of mineral oil into the pump's interior.

5.4 Preserving the Pump

Preserving the Pump

ⓘ The pump should only be preserved on the exterior.

WARNING

Damage to Property!
Improper preservation or no preservation at all may cause corrosion to the pump.

- If required, properly preserve the pump
  ⇨ Chap. " Preservation Conditions", Page 31

Pre-Conditions:

- Pump has been demounted.
  ⇨ Chap. "9.1 Demounting the Pump", Page 55
- Pump is clean and dry.
- All openings are closed using flange covers or caps.

Procedure:

1. Apply corrosion preventative (Castrol SafeCoat DW 18X) evenly to the pump's exterior surface.
2. Allow the pump to dry.

ⓘ Before the initial set-up of the pump, it does not need to be de-preserved.

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6 Mounting

Mounting

For pumps in explosive areas, the supplementary documentation should also be observed: ⇨ User Manual RKP II Explosion-Proof

For any and all tasks to be performed on the pump, suitable personal protective equipment should be worn.
⇨ Chap. "2.2.4 Work Safety", Page 9

DANGER

Risk of injury and property damage as a result of leaking operating fluid!
Any operating fluid that sprays out under high pressure because of improper mounting may lead to serious injury or property damage.

- Only trained personnel should be allowed to mount the pump.
- Check the cleanliness of the mounting surface.
- Observe the tightening torques for the fasteners.
  ⇨ Chap. "12.4 Tightening Torque", Page 65
- Use only specified fasteners (quantity/type).
- Make sure the proper flange and screws are being used as per standard (e. g. SAE).
- Check for the existence and use of the proper O-rings.
- Use the correct sealant based on the operating fluid.
- Mount all connections to be hydraulically sealed.
- Do not exceed the maximum operating pressure in the system.
- Do not exceed the maximum body pressure.

DANGER

Serious bodily injury!
Starting-up the machine/equipment during the mounting process may lead to serious bodily injuries or death.

- Make sure that the machine/equipment cannot be switched on.

6.1 Preparing for mounting

Preparing for mounting

The pump is pre-assembled at the factory.

Procedure:

1. Pump has been unpacked.
   ⇨ Chap. "5.1 Unpacking the Pump", Page 29
2. The required supplementary documentation is at hand.
3. The hydraulic plans from the machine / equipment manufacturer have been made available.
4. The required standard tools and mounting material are at hand.

6.2 Installing the Pump

Installing the Pump

WARNING

Risk of Crushing!
During mounting, the pump may topple over and crush body parts.

- Select lifting tackle to correspond with the overall weight of the pump.
- Attach the lifting tackle to the pump properly.
  ⇨ Chap. "5.2 Transporting the Pump", Page 29
- Avoid all areas below the floating load.

WARNING

Risk of injury and poisoning by dangerous operating fluid!
Leaks from dangerous operating fluid may lead to serious injuries.

- Check to ensure that the operating fluid in use does not pose a risk.
- Make sure that the machine / equipment is at zero pressure and idle.
- Wear protective work equipment such as, e. g., work gloves. ⇨ Chap. "2.2.4 Work Safety", Page 9

DANGER

Risk of Death by Electrocution!
Contact with hot parts may lead to severe injuries and even death.

- Make sure that the machine / equipment is idle.

CAUTION

Damage to Property from Soiling!
Removing end caps to the pump connections may lead to soiling and as a result property damage.

- Do not remove end caps until shortly before mounting.

WARNING

Risk of injury and property damage as a result of vibration!
Vibrations from machines / equipment parts may lead to bodily injury or property damage.

- Uncouple the pump using suitable antivibration elements.

Pre-Conditions:

- Mounting area is freely accessible.
- Machine / equipment is at zero pressure and idle.
- Operation fluid matches the information on the order data sheet.
- Standard tools and mounting material are at hand.
- Supplementary documentation is available.
- The specified rotation of the pump corresponds with the drive motor.

ⓘ The pump's mounting position is optional.

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Procedure:

1. Mount the specified half of the coupling to the pump's drive shaft as per the information provided by the coupling manufacturer.

   ⓘ The threaded bore on the pump's drive shaft can be used to mount the coupling.

2. Make sure that the connection and mounting surfaces are clean.
   - If not, clean the connection and mounting surfaces using suitable cleaning agents.
   - Use suitable cleaning rags.
   - Do not allow the cleaning agent to penetrate into the hydraulic circulation loop.
3. Ensure that the coupling hub is tightened to the drive shaft or that the drive shaft is lubricated continuously to prevent wear from vibration.
4. Transport the pump to the mounting location.
5. Mount the coupling to the drive according to the information provided by the coupling manufacturer.

   ⓘ Only bolt the pump down after the coupling has been mounted correctly.

6. Fasten the pump with the coupling at the mounting location. Tighten the mounting screws with the adequate tightening torque crosswise.
   ⇨ Chap. "12.4 Tightening Torque", Page 65
7. For bell housing mounting: Check the coupling's axial clearance as per the information provided by the coupling manufacturer.
8. For mounting a flange: Align the pump supports in the direction of the drive.
9. For elastic couplings: After completing the mounting, check the drive to make sure it does not vibrate.

6.3 Planning Lines

Planning Lines

ⓘ In order to minimize the development of noise from the transmission of structure-borne noise, observe the following:
- Use hoses instead of pipes.
- Secure pipes with elastic clamps.

Suction Line

WARNING

Damage to property from cavitation!
Lack of pressure in the suction line may lead to the formation of air bubbles in the operating fluid and as a result may lead to severe damage to the pump.
- Configure the layout of the suction lines so that the inlet pressure cannot be any lower than the minimum of 0.8 bar absolute at the suction port.
- Ensure that the operating fluid has the correct viscosity.

- Short suction lines with wide inside diameters are needed to ensure that the noise output is low.
- Suction speed < 1 m/sec.

- Avoid sharp angles and screwed pipe joints (danger of air intake and dispersion, high flow resistance). Use curved pipes or hoses instead.
- Maintain the minimum inlet pressure.
- Only reduce the length of the suction line at the pump entry.
- If a suction filter (min. 0.15 mm mesh aperture) or a shut-off valve is used, install the devices below the fluid level.

Pressure Line

- Ensure sufficient stability.
- Inspect the tightening torques of the screws.

Drain Line

- Install the drain line so that the pump housing is always completely filled with pressure fluid (use the upper connection).
- It should lead directly into the tank separated from the other return lines.
- The end of the line must be below the fluid line in the tank, even at the lowest fluid level.
- The distance from the suction line should be as large as possible. Do not place a filter, cooler or non-return valve in the drain line. Max. length 3 m.
- Pressure at the drain line max. 2 bar absolute (1 bar above atmosphere).
- The recommended outside diameter of the pipe used as a drain line (lightweight version): ⇨ Tab. 3, Page 27

6.4 Connecting Pipes

Connecting Pipes

ⓘ For the pump, the connections do not depend on the direction of the rotation.

Procedure:

ⓘ For securing the control and leak oil port and the suction and pressure flange, the appropriate screw connections must be used.

1. Remove the end caps from each connection.
2. Clean the sealing surfaces and the lines.
3. Connect the lines in accordance with the block diagram (suction line **A**, pressure line **B**). ⇨ Chap. "12.4 Tightening Torque", Page 65
4. For pumps with load sensing compensator with p-T control notch
   - The compensator's tank line may **not** be combined with the pump's leak oil line.
5. For multiple pump arrangements, which are equipped with the "load sensing compensator with p-T control notch", in the event that a circular flow is required:
   - Only connect the tank line to the tank at the compensator of the first pump to activate the p-T control notch.
   - Close off the compensators' t-connections for the add-on pumps.

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6.5 Electrically connecting the pump

Electrically connecting the pump

ⓘ The pump's electrical is connected through the control unit:
⇨ Application Instruction RKP-D with CAN Bus Interface

6.6 Arranging Multiple Pumps

6.6.1 Determining the through drive torque

Arranging Multiple Pumps, Determining the through drive torque

Additional pump stages can be mounted axially to the pump and as a result, all pumps can be driven by the same shaft. Available for multiple mounting purposes are radial piston pumps (the maximum size to be selected should be equal to pump stage 1) or other pumps with adapter flanges for SAE-A or SAE-B. For the maximum permissible through drive torque of the added pumps, see the table below. ⇨ Tab. 7, Page 37

Through Drive Torque for Added RKP, SAE-A- or SAE-B Adapters

Pump Stage 1	**Pump Stage 2**					
RKP-II	**RKP-II**				**SAE-A**	**SAE-B**
Size [cm^3/R]	19	32 45	63 80 100	140	–	–
19	90 Nm	–	–	–	110 Nm	–
32/45	185 Nm	185 Nm	–	–	110 Nm	185 Nm
63/80/100	400 Nm	400 Nm	400 Nm	–	110 Nm	280 Nm
140	400 Nm	400 Nm	400 Nm	620 Nm	110 Nm	280 Nm

Tab. 7: Permissible Through Drive Torques

The required through drive torque to drive the added on pumps should be determined by using the following variables:

V [cm^3/R] : Displacement
p [bar] : Pressure
η_{hm} [%] : Hydro-mechanical efficiency
M [Nm] : Through drive torque

Through Drive Torque of Pump Stage 1 to 2:

Formula for Through Drive Torque for Multiple Pumps

$$M_1 = 1{,}59 \cdot \sum_{i=2}^{n} \frac{V_i \cdot p_i}{\eta_{hm_i}}$$

Example:

Based on a pump combination
RKP 63 + RKP 63 + RKP 32 + AZP 16
280 bar, 210 bar, 150 bar, 50 bar
this would mean:

Design of the first through drive

The pressure and the current flow for the first pump have no effect on the torque transferred by the through drive. According to the formula shown above, this torque is the result of

$$M_1 = 1{,}59 \cdot \left(\frac{V_2 \cdot p_2}{\eta_{hm_2}} + \frac{V_3 \cdot p_3}{\eta_{hm_3}} + \frac{V_4 \cdot p_4}{\eta_{hm_4}} \right)$$

$M_1 = 1{,}59 \cdot (63 \cdot 210 / 95 + 32 \cdot 150 / 93 + 16 \cdot 50 / 90)$ Nm

$M_1 = 318$ Nm

The variable 318 Nm is below the threshold value of 400 Nm listed in the table for adding on an RKP 63 to an RKP 63.

Design of the second through drive

$$M_2 = 1{,}59 \cdot \left(\frac{V_3 \cdot p_3}{\eta_{hm_3}} + \frac{V_4 \cdot p_4}{\eta_{hm_4}} \right)$$

$M_2 = 1{,}59 \cdot (32 \cdot 150 / 93 + 16 \cdot 50 / 90)$ Nm

$M_2 = 96$ Nm

Again in this case, the variable 96 Nm is below the respective threshold value of 400 Nm for the through drive for the arrangement of an RKP-II 63 to an RKP-II 32.

Design of the third through drive

In the same manner, 14 Nm is obtained for the torque required to drive the added on gear pump. As a result, the through drives of these pump arrangements are permissible with the specified pressure values.

Section Diagram Multiple Pumps

Section Diagram Multiple Pumps

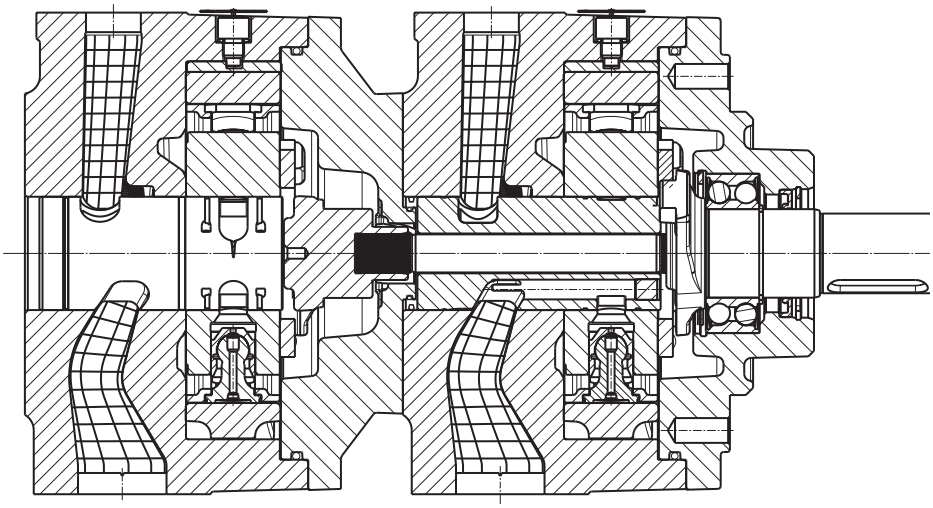

Fig. 19: Radial Piston Pump with Heavy Through Drive and Add-On Radial Piston Pump

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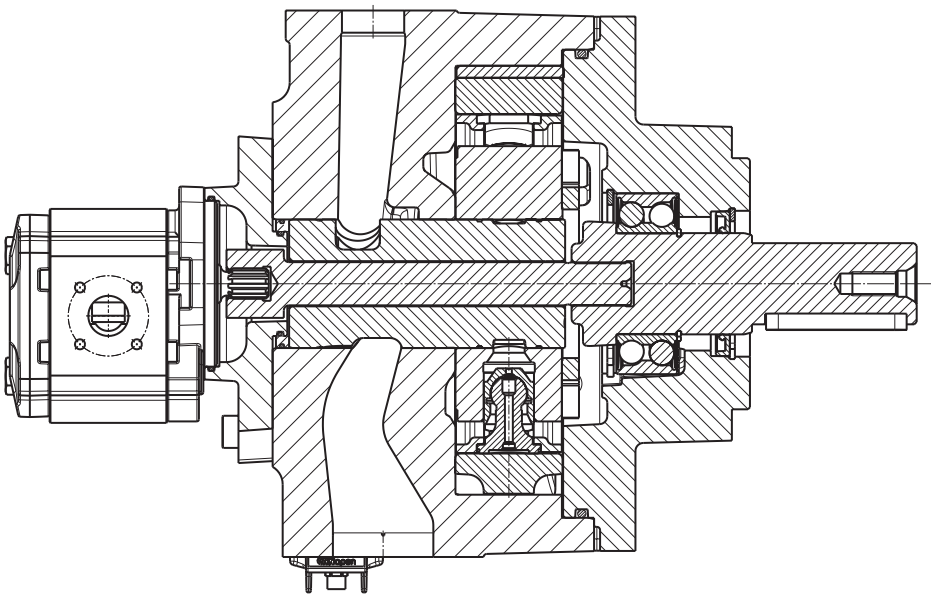

Fig. 20: Radial piston pump with tandem mounted gear pump using SAE-A adapter

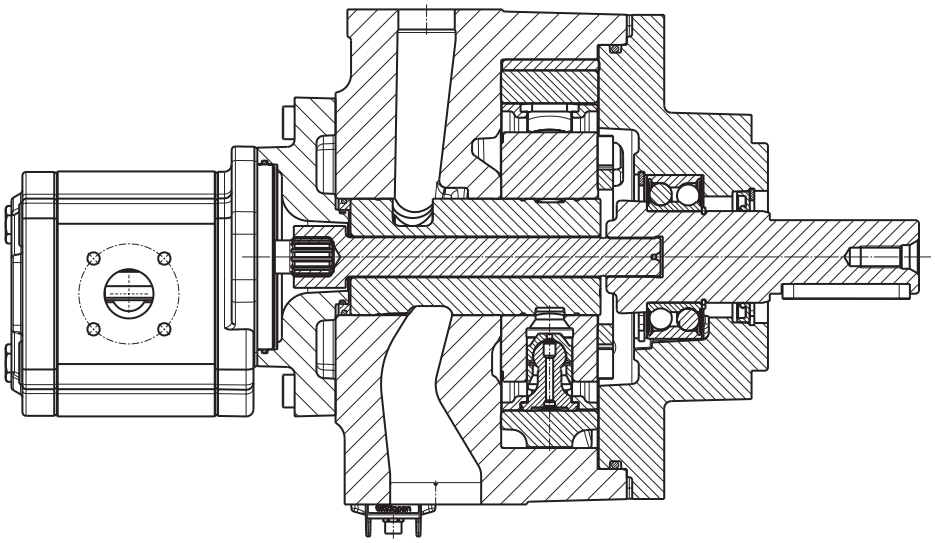

Fig. 21: Radial piston pump with tandem mounted gear pump using SAE-B adapter

6.6.2 Attaching the Adapter Flange

Attaching the Adapter Flange

Pre-Conditions:

- The centering diameters of both the adapter flange and the add-on pump match.
- The dimensions of the through drive shaft match with the add-on pump.
- The flange diameters of both the adapter flange and the add-on pump match.
- The connection surfaces are clean.

Procedure:

1. Attach the adapter flange to the add-on pump without damaging the O-rings.
2. Bolt the adapter flange to the pump:
   - Observe the tightening torques of the fasteners.
     ⇨ Chap. "12.4 Tightening Torque", Page 65

For adding on a pump, the following adapter flanges are available:

Adapter flange SAE-A with 9-tooth shaft

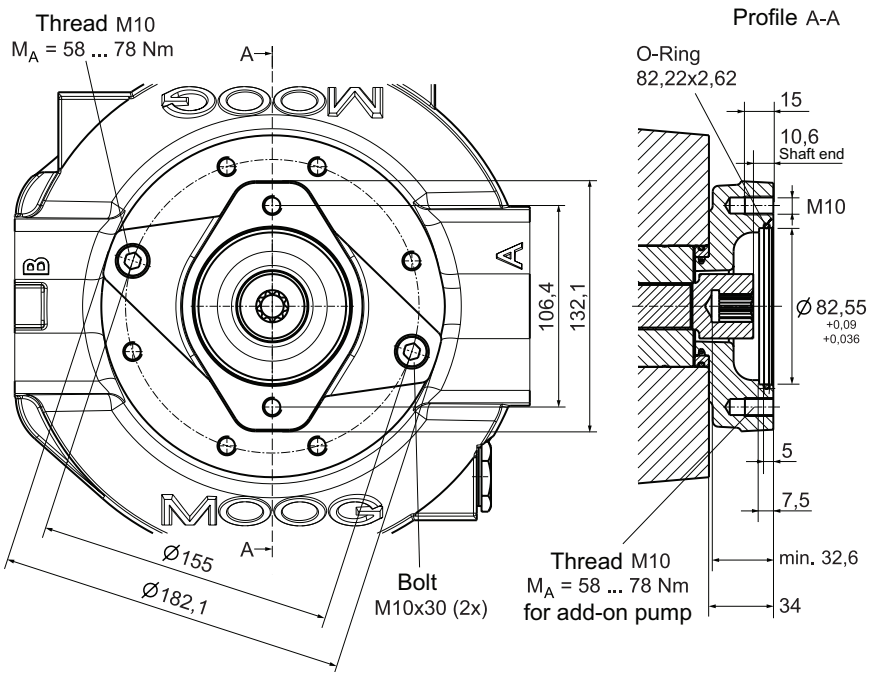

Fig. 22: Adapter flange SAE-A with 9-tooth shaft

Flange Code:	82-2
Shaft Code:	16-4
Spline as per:	ANSI B92.1 9T 16/32 DP Flat root side fit
Conditions for attachment:	RKP with heavy-duty through drive

The adapter includes through drive shaft, seals (HNBR), intermediate ring for RKP 63–140 and two fastening screws.

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Adapter flange SAE-A with 13-tooth shaft

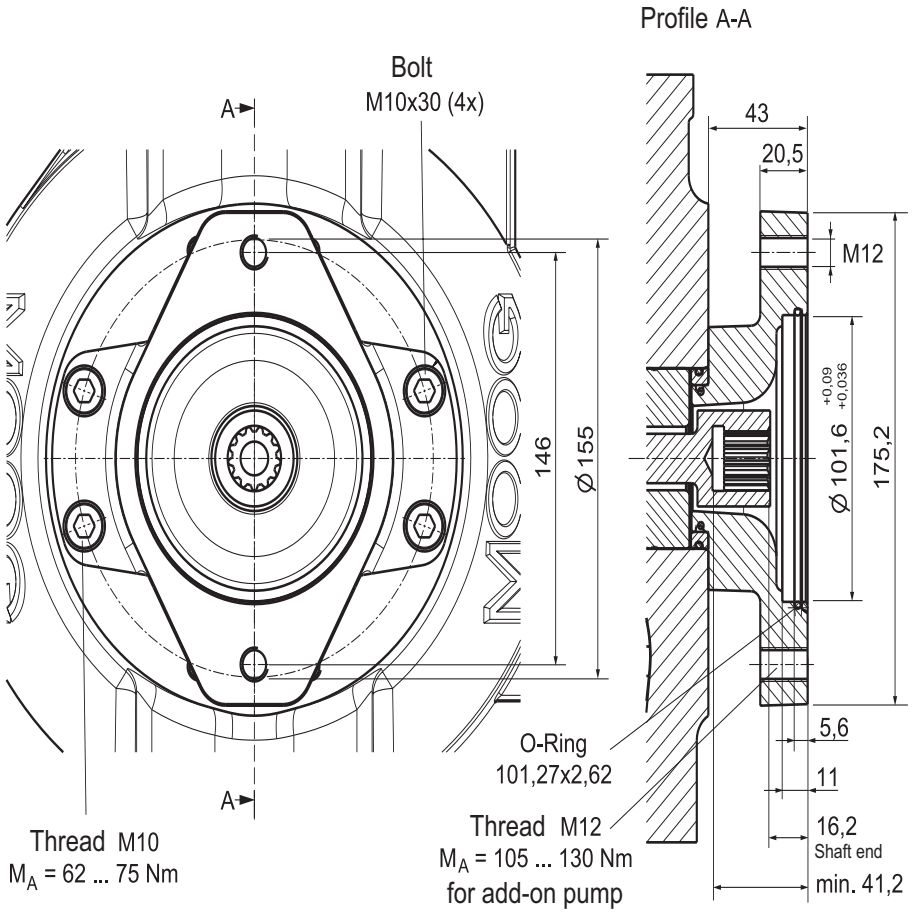

Fig. 23: Adapter flange SAE-A with 13-tooth shaft

Flange Code:	101-2
Shaft Code:	22-4
Spline as per:	ANSI B92.1 13T 16/32 DP Flat root side fit
Conditions for attachment:	RKP with heavy-duty through drive

The adapter includes through drive shaft, seals (HNBR), intermediate ring for RKP 63–140 and four fastening screws.

For your notes.

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7 Operation

Operation

For pumps in explosive areas, observe the supplementary documentation as well:
⇨ User Manual RKP II Explosion-proof

For any and all tasks to be performed on the pumps, appropriate personal protective equipment should be worn.
⇨ Chap. "2.2.4 Work Safety", Page 9

7.1 Initial Pump Set-Up

Initial Pump Set-Up

CAUTION

Damage to the pump!
Setting up the pump for initial operation without the required basic mechanical and hydraulic knowledge may result in damage to the pump.

- The pump may only be set up initially by qualified personnel.

DANGER

Risk of injury and property damage as a result of blows or impact!
Unexpected and uncontrolled movement of the machine / equipment may lead to severe injury or property damage.

- Only trained personnel should be allowed to initially set-up the pump.
- Have the equipment manufacturer or operator assure that no uncontrolled signals are being transmitted to the pump.
- Have the equipment manufacturer or the operator assure that a pump malfunction (e. g. piston jam caused by crud) is recognized so that a malfunction of the axle / machine / equipment can be prevented.
- Ascertain that all plug connections are wired and allocated correctly.
- Make sure that all hydraulic ports are connected correctly.
- Make certain that the rotational direction of the drive motor is correct.
- Check for correct drive shaft connection to the drive motor.
- Have the equipment manufacturer or operator assure that customer specific parameters were loaded correctly.

WARNING

Risk of poisoning and injury!
Contact with the operating fluid can cause health problems, such as injury to eyes, damage to the skin or inhalation poisoning.

- Before initial set-up, check the lines and connection ports for any damage.
- Adhere to the operating fluid manufacturer's safety instructions.

WARNING

Risk of injury and property damage as a result of fire!
Easily inflammable operating fluid may cause fire.

- Keep the pump away from any open flames.

WARNING

Risk of Burns!
Pump parts run hot while in operation.

- Do not touch the pump while it is running.

WARNING

Risk of injury and property damage as a result of engaging or winding!
Freely accessible rotating machine / equipment parts may lead to severe injuries or property damage as a result of engaging or winding.

- Use suitable protective devices to ensure that access to the drive shaft is blocked.

7.1.1 Filling up the Pump

Filling up the Pump

The pump must be completely filled with operating fluid before initial operation.

Procedure:

1. Fill the pump through the leakage oil port with operating fluid completely.

7.1.2 Adjusting the Compensator

Adjusting the Compensator

Information on the compensator functions:
⇨ Chap. "3.5 Compensator Operation", Page 15

All compensators are pre-set at the factory. In this section, information on the parameters needed to adjust the compensators is provided.

The following information is the same for F, H, J and R compensators:

Tightening torque for the lock nuts of the adjusting screw for adjusting the compensator pressure: SW 19 = 10 Nm + 5 Nm

Procedure:

1. Depending on the compensator, refer to the respective subchapter.
2. If required: Adjust the compensator according to the information provided in the subchapter.
3. For G compensators: Adjust the compensator using the lockable adjustment knob.

7.1.2.1 Hydraulically Driven Remote Pressure Compensator, H1

Information on the compensator:
⇨ Chap. "3.5.2 Hydraulically Driven Remote Pressure Compensator, H1", Page 17

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ⓘ The information in this section also applies to: ⇨ Chap. "3.5.4 Load Sensing Compensator, J1", Page 19

ⓘ When high dynamics are required for flow control, orifice and control flow volume, contact us to discuss application specific compensator adjustments.

Default Compensator Settings

Δp = 10 bar + 2 bar or Δp = 20 bar + 2 bar

Hose for Control Line

The following information are recommended values:

Hose length approx. 800 mm

Pump Type	NW [mm]
RKP-II 19	6
RKP-II 32, 45	8
RKP-II 63, 80, 100	10

Tab. 8: Nominal width for Control Line Hose

7.1.2.2 Load Sensing Compensator with p-T Control Notch, R1

ⓘ Information on the compensator:
⇨ Chap. "3.5.5 Load Sensing Compensator with p-T Control Notch, R1", Page 20

Default Compensator Settings

RKP-II 16–100: Δp = 10 bar + 2 bar
RKP-II 140: Δp = 13 bar + 2 bar

Hose for Control Line

The following information provides recommended values:

Hose length approx. 800 mm

Pump Type	NW [mm]	D1 [mm]	D2 [mm]
RKP-II 19, 32, 45	6	0.9	1.2
RKP-II 63, 80, 100	8	0.9	1.2
RKP-II 140	8	0.8	1.1

Tab. 9: Nominal width for Control Line Hose

7.1.2.3 Mechanical Stroke Adjustment

ⓘ Information on stroke adjustments:
⇨ Chap. "3.5.6 Mechanical Stroke Adjustment, B1", Page 21

ⓘ When adjusting the required flow volume, make sure that the stroke ring is held tight between the two adjustment screws.
Upon delivery, the pump is set to $V_{max.}$.

The information in the following table refers to ⇨ Fig. 10, Page 21

Displacement V [cm³/U]	19	32	45	63	80	100	140
Pos.1	WS 8 = 15 Nm + 5 Nm			WS 8 = 25 Nm + 5 Nm			
Pos. 2	WS 24 = 200 Nm ± 10 Nm						
ΔV for 1 mm adjusting screw travel (pitch 1.5 mm/R)	3.6	5.6	6.5	8.9		11.3	11.5

Tab. 10: Mechanical Stroke Adjustment

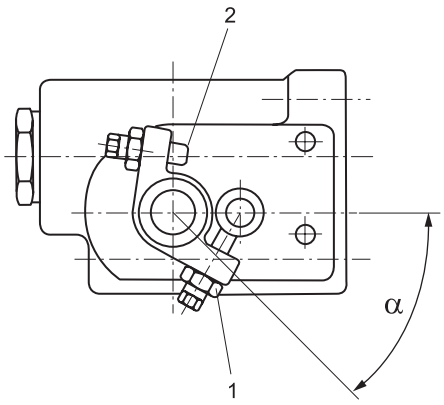
Procedure:

1. Set the adjusting screws of the mechanical stroke adjustment and tighten them.
   - Tightening torque ⇨ Tab. 10, Page 46
2. Secure the adjusting screws with SEAL-Lock® sealing nuts SW 24 (M16x1.5).
   - Tightening torque M_A= 200 Nm ± 10 Nm.
3. Attach a note that the seal capacity can no longer be guaranteed after loosening them five times.
   - If required: replace SEAL-Lock® sealing nut.

7.1.2.4 Servo Control, C1

ⓘ Information about the Servo Control:
⇨ Chap. "3.5.7 Servo Control, C1", Page 22

ⓘ The zero position and the end position are set at the factory. Manual or mechanical operations are performed using the adjustment lever.



Pos.	Description
1	Zero position (set at the factory)
2	End position / $\pm V_{max.}$ (set at the factory)

Fig. 24: Servo Control, C1

Displacement V [cm³/R]		19	32	45	63	80	100
Angle α [°]		44	47	57	44	56	56
Control torque M [Nm]	Zero position	1.2			1.6		
	End position	1.6	1.7		2.4	2.6	2.6
	max.	8					

Tab. 11: Adjustment Torque Servo Control

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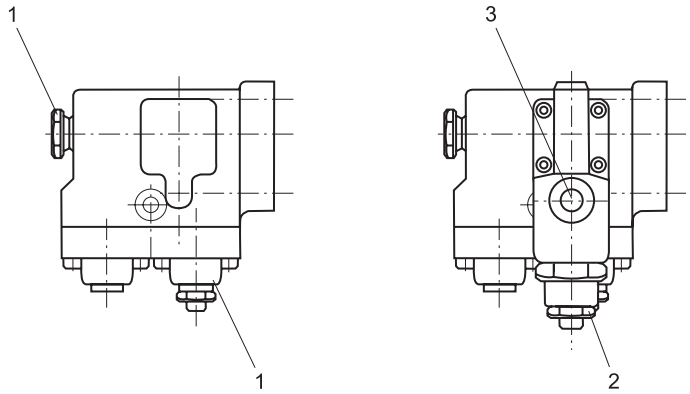
Procedure:

1. Regulate the pump's flow volume by positioning the adjustment lever.

7.1.2.5 Power Control, S1, S2

ⓘ Information on the power control:
⇨ Chap. "3.5.8 Power Control, S1", Page 23
⇨ Chap. "3.5.9 Power Control, S2", Page 25

ⓘ **The power control settings are set at the factory and may not be changed!**



Pos.	Description
1	Power control setting (set at the factory; may not be changed)
2	Pressure decrease (set at the factory Δp = 10 bar + 2 bar)
3	Control port G 1/4"

Fig. 25: Power Control, S1, S2

Default Compensator Settings

Δp = 10 bar + 2 bar

Hose for Control Line

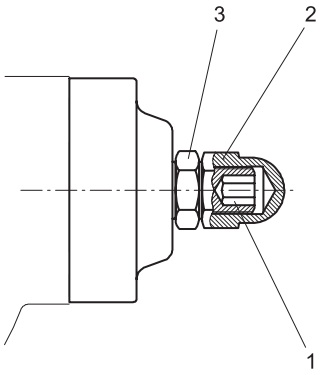
The following information provides recommended values:

Hose length approx. 800 mm

Pump Type	NW [mm]
RKP-II 19	6
RKP-II 32, 45	8
RKP-II 63, 80, 100	10

Tab. 12: Nominal width for Control Line Hose

7.1.2.6 Limiting the Maximum Flow



Pos.	Description
1	Adjustment mandrel
2	Cap nut
3	Lock nut

Fig. 26: Limiting the Maximum Flow

Displacement V [cm^3/R]	19	32	45	63	80	100	140
Pos.1	WS 8			WS 12			WS 10
Pos. 2	WS 24 = 40 Nm + 10 Nm			WS 32 = 80 Nm + 10 Nm			WS 27 = 80 Nm + 10 Nm
Pos. 3	WS 24 = 50 Nm + 10 Nm			WS 32 = 90 Nm + 10 Nm			WS 27 = 90 Nm + 10 Nm
ΔV for 1 mm adjusting screw travel (pitch 1.5 mm/R)	3.6	5.6	6.5	8.9		11.3	11.5

Tab. 13: Adjustments Limiting the Maximum Flow

7.2 Performing Functions Tests

Performing Functions Tests

ⓘ The functions tests is performed to ensure that the pump has been installed into the machine / equipment properly.

Pre-Conditions:

- Initial set-up of the pump is complete: ⇨ Chap. "7.1 Initial Pump Set-Up", Page 43
- The end caps on the through drive of the pump stages have been removed.
- It has been assured that the pump is being supplied with operating fluid.
- The pump has been visually inspected, with particular attention given to the lines and port connections.

Procedure:

1. Carry out the functions test in accordance with the instructions provided by the machine / equipment manufacturer.

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2. In doing so, watch especially for:
   - Noise development
   - Any exterior leaks

7.3 Operating the Pump

DANGER

Bodily injuries and property damage!
Incorrectly setting the pump in operation may lead to unexpected and uncontrolled movements of the machine / equipment and as a result may lead to bodily injuries or property damage.

- Only trained personnel should be allowed to operate the pump.
- Have the equipment manufacturer or operator assure that no uncontrolled signals are being transmitted to the pump.
- Have the equipment manufacturer or the operator assure that a pump malfunction (e. g. piston jam caused by crud) is recognized so that a malfunction of the axle / machine / equipment can be prevented.

Operating the Pump

WARNING

Risk of Burns!
Pump parts run hot while in operation.

- Do not touch the pump while it is running.

WARNING

Damage to Property!
Operating the pump without operating fluid will result in the pump running dry and damage to the pump.

- Only start up the pump when the pump housing is completely filled with operating fluid.

7.3.1 Start up

Start up

Pre-Conditions:

- Pump has been filled. ⇨ Chap. "7.1.1 Filling up the Pump", Page 44
- The temperature of the operating fluid in the tank does not exceed the pump temperature by more than 25 °C.

Procedure:

If the temperature of the operating fluid in the tank exceeds the pump temperature by more than 25 °C, the pump should only be switched on in short intervals of 1 to 2 seconds until it has heated up.

1. Start up the drive motor.
2. Check the rotational direction of the drive motor.
3. Operate the pump at low pressure until the hydraulic system has been de-aerated.
4. For pumps with HF fluids: Run the pump for approx. one hour at low pressure (30–50 bar).

7.3.2 Flushing the Pump

Flushing the Pump

If the pump is operated for longer periods of time at low pressure without delivery (t > 15 min, p < 30 bar, Q = 0 l/min) it will be necessary to flush the pump to dissipate the heat.

Procedure:

1. The flushing line must be connected to the pump's lowest leakage connection.
2. Flush the pump using operating fluid quantities depending on pump size:

Displacement V [cm^3/R]	19	32	45	63	80	100	140
Flushing quantity [l/min]	4–6						6–8

Tab. 14: Flushing Quantity

7.4 Placing the Pump out of Operation

Placing the Pump out of Operation

DANGER

Risk of injury and property damage as a result of blows or impact!
Unexpected and uncontrolled movement of the machine / equipment may lead to severe injury or property damage.

- Only trained personnel should be allowed to remove the pump.
- Have the equipment manufacturer or operator assure that no uncontrolled signals are being transmitted to the pump.
- Make sure that the drive motor cannot start up.

WARNING

Risk of injury and poisoning by dangerous operating fluid!
Leaking operating fluid may lead to severe personal injury and property damage.

- Only trained personnel should be allowed to place the pump out of operation.

Pre-Conditions:

- The drive motor has been switched of and is secured from being switched back on.
- Machine / equipment is at zero pressure and idle.
- Pump has cooled down.

Procedure:

1. Close the fittings on the suction and pressure side.
2. Completely drain the pump through the leakage oil port.
3. Depending on what is required:
   - Remove the pump:
     ⇨ Chap. "9.1 Demounting the Pump", Page 55
   - Storing the Pump:
     ⇨ Chap. "5.3 Storing the Pump", Page 31

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7.5 Reconnecting the Pump

Reconnecting the Pump

Pre-Conditions:

- If the pump was stored: Measures were carried out that were necessary because of the duration of storage. ⇨ Tab. 6, Page 31
- Pump is installed. ⇨ Chap. "6 Mounting", Page 33

Procedure:

1. Carry out all steps applicable for the initial set-up of the pump.
   ⇨ Chap. "7.1 Initial Pump Set-Up", Page 43

For your notes.

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8 Maintenance and Repairs

Maintenance and Repairs

For pumps in explosive areas, the supplementary documentation should also be observed:
⇨ User Manual RKP II Explosion-proof

For any and all tasks to be performed on the pump, suitable personal protective equipment should be worn.
⇨ Chap. "2.2.4 Work Safety", Page 9

8.1 Monitoring

Monitoring

Tasks	Intervals
Check pump for leakage	Daily
Check pump for noises	Daily
Check that fasteners are tightened	Monthly
Check the machine's operating temperature at constant operating conditions	Weekly
Check the machine's operating fluid level	Daily
Check the operating fluid quality	Annually or every 2000 operating hours

Tab. 15: Monitoring

8.2 Trouble-shooting

Trouble-shooting

ⓘ Should repairs be needed because of any trouble with the pump, these should only be carried out by one of our service technicians or by an authorized service location.
⇨ Chap. "2.2.3 Structural Modifications", Page 9
⇨ Chap. "8.3 Moog Service Addresses", Page 54

Trouble	Cause	Repair
Radial Piston Pump		
Peculiar noises	Cavitation, Pump is sucking air, speed is too high, mechanical damage	Configure the inlet suction so that the pressure in the suction line is not below minimum, limit the speed settings, contact us and have damaged parts replaced
Flow volume too low or non-existent	Pump does not cut off, leakage in the pump, comparing performance of drive motor and pump shows no match, wear caused by dirt, engine damage	Check inlet suction, check for wear, check adjustable parts, contact us and have damaged parts replaced
Pressure too low or non-existent	Pump does not cut off, leakage in the pump, comparing performance of drive motor and pump shows no match, wear caused by dirt, engine damage	Check cut-off, seal leaky lines, check actuation, contact us and have damaged parts replaced
Fluctuations in the pressure or displacement	Pump is sucking air, leakage in the pump, wear caused by dirt, engine damage unstable compensator	Seal leaking areas, check the configuration of the antivibration orifice and if necessary, use the correct antivibration orifice, check the dimensions of the control oil hose and if necessary, replace with the correct control oil hose, contact us and have damaged parts replaced

Tab. 16: Trouble-shooting

8.3 Moog Service Addresses

Moog Service Addresses

ⓘ Visit www.moog.com/worldwide to find the location nearest you for application engineering, repairs and service.

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9 Demounting

Demounting

For pumps in explosive areas, the supplementary documentation should also be observed:
⇨ User Manual RKP II Explosion-Proof

For any and all tasks to be performed on the pumps, appropriate personal protective equipment should be worn.
⇨ Chap. "2.2.4 Work Safety", Page 9

9.1 Demounting the Pump

Demounting the Pump

In this segment, instructions are given on how to dismantle the pump to prepare it for shipping to us or to one of our authorized service locations for pump repairs to be performed and not on how to disassemble the pump.

WARNING

Risk of crushing!
During demounting, the pump may topple over and crush body parts.

- Select lifting gear appropriate for the overall weight of the pump.
- Attach the lifting gear to the pump properly.
  ⇨ Chap. "5.2 Transporting the Pump", Page 29
- Avoid all areas below the floating load.

WARNING

Risk of injury and poisoning by dangerous operating fluid!
Leaks from dangerous operating fluid may lead to serious injuries.

- Check to ensure that the operating fluid in use does not pose a risk.
- Make sure that the machine / equipment is at zero pressure and zero voltage.
- Wear protective work equipment such as, e. g., work gloves. ⇨ Chap. "2.2.4 Work Safety", Page 9

WARNING

Risk of death by electrocution!
Contact with live parts may lead to severe injuries and even death.

- Make sure that the machine / equipment is at zero voltage.

CAUTION

Damage to property from contamination!
Missing end caps to the pump connections may lead to contamination and resulting damage to property.

- Replace the end caps immediately after demounting the lines on the pump.

Pre-Conditions:

- The pump is idle:
  ⇨ Chap. "7.4 Placing the Pump out of Operation", Page 50
- Demounting location is freely accessible.
- Machine / equipment is at zero pressure and zero voltage.
- Operating fluid has been inspected for risks and any necessary safety precautions have been taken.
- Standard tools are available.
- Supplementary documentation is available.

Procedure:

1. Remove the electrical connections from the pump:
   ⇨ Application Instruction RKP-D with CAN Bus Interface
2. Place the collecting tray for leaking operating fluid underneath the pump.
3. Remove the lines from the pump.
4. Completely drain the pump.
5. Attach the end caps and the flange covers to the pump.
6. Attach suitable lifting tackle to the pump.
   ⇨ Chap. "5.2 Transporting the Pump", Page 29
7. Detach the pump with the coupling from the drive motor.
8. Place the pump onto a firm and stable surface.
9. Detach the lifting gear from the pump.
10. Detach the coupling from the pump's drive shaft in accordance with the instructions provided by the coupling manufacturer.
11. Attach transport protection means for shaft ends to the pump's drive shaft.

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10 Spare Parts, Accessories, Repairs

Spare Parts, Accessories

The operator is not authorized to install spare parts and accessories. Repairs or other structural modifications to the pump may only be carried out by us or by an authorized service repair shop.
⇨ Chap. "2.2.3 Structural Modifications", Page 9

Tools

For all tasks described in this User Manual, commercially available standard tools may be used.

CAUTION

Property damage to the pump or equipment!
Unsuitable or defective accessories or spare parts may lead to pump or machine / equipment failure as a result of damage.

- We recommend: Only use original accessories or spare parts.
- All warranties and liability claims shall be void for injuries or property damage as a result of using unsuitable or defective accessories or spare parts.
⇨ Chap. "1.5 Warranty and Liability", Page 5

Repairs

Steps to be taken when carrying out repair work:

1. For repairs to the pump:
⇨ Chap. "9.1 Demounting the Pump", Page 55
2. Package the pump for transport to our facility or to an authorized service repair shop, preferably in its original packaging material.
⇨ Chap. "8.3 Moog Service Addresses", Page 54

For your notes.

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12 Appendix

12.1 Declaration of Conformity

MOOG

MOOG GmbH
Hanns-Klemm-Str. 28
71034 Böblingen

Division Industry

Declaration of conformity

as defined by machinery directive 89/392/EEC Annex IIB
and directive 94/9/EC (ATEX), Annex X

Herewith we declare that the supplied model

Radialpistonpump

(detailed model & serial number is referenced on the delivery note)

is intended to be incorporated into machinery or machinery parts, or assembled with other machinery or machinery parts to constitute machinery covered by this directive and must not be put into service until the machinery into which it is to be incorporated has been declared in conformance with the provisions of the directive as amended by 98/37/EC and directive 94/9/EC.

The admission of the series is registered/deposited under:

BVS 06 ATEX H / B 052

Applied harmonized standards
in particular:

EN982:	"Safety of machinery - Safety requirements for fluid power systems and their components hydraulics."
EN 1127-1	Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology
DIN EN 13463-1	Non-electrical equipment for potentially explosive atmospheres – Part 1: Basic concepts and requirements

Moog GmbH
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Harald Seiffer
General Manager

Richard Kohse
Quality Manager
Representative for ATEX Directive 94/9/EC

Böblingen, 24.04.2006

g:\user\qa\..\formqa\QAF138E EX Declaration of Conformity Exschutz RPP Rev. d / 06.05.2004

Fig. 27: Declaration of Conformity

12.2 Manufacturer's Declaration

MOOG

MOOG GmbH
Hanns-Klemm-Str. 28
71034 Böblingen

Division Industry

Declaration by the Manufacturer

as defined by machinery directive 89/392/EEC Annex IIB

Herewith we declare that the supplied model

Radialpistonpump

(Model- and serial number are listed on the delivery note)

is intended to be incorporated into machinery or machinery parts, or assembled with other machinery or machinery parts to constitute machinery covered by this directive and must not be put into service until the machinery into which it is to be incorporated has been declared in conformance with the provisions of the directive as amended by 98/37/EC.

Applied harmonized standards
in particular

EN982: "Safety of machinery -
Safety requirements for fluid power systems and
their components hydraulics"

In addition for products with integrated electronics:

EN 55011:1998 + A1:1999 (Limit class: B) Electromagnetic compability (EMC)
Generic emission standard

EN 61000-6-2:1999 Electromagnetic compability (EMC)
Generic immunity standard

Our products are not CE marked as they are classified as components according to the EMC ruling dated 9 December 1992 paragraph 5, section 5.

MOOG GmbH
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Harald Seiffer
General Manager

Richard Kohse
Quality Manager

Böblingen, 06.05.2004

g:\user\qa\...\formqa\Qaf106e Declaration by the Manufacturer RKP.doc Rev. a / 06.05.2004

Fig. 28: Manufacturer's Declaration

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12.3 Abbreviations, Symbols and Code Letters

Abbreviations, Symbols and Code Letters

Abb.	Explanation
β_x	Symbol for filter efficiency
Δp	Symbol for pressure change
Δp_N	Symbol for nominal pressure change
ν	Symbol for viscosity
A	Connection port (consumer load connection)
ANSI	**A**merican **N**ational **S**tandards **I**nstitute (http://www.ansi.org)
ATEX	**At**mosphère **ex**plosible (synonymous for the EU Directive pertaining to explosion protection)
B	Connection port (consumer load connection)
D	**O**rifice
D1, D2	**Orifice** diameter
DIN	**D**eutsches **I**nstitut für **N**ormung e. V. (http://www.din.de)
EN	**E**uropa-**N**orm (=European Standard)
EU	**E**uropean **U**nion
HFA	Special operating fluid: consists of approx. 95% water
HFC	Special operating fluid: water-based polymer solution
HNBR	**H**ydrogenated **N**itrile**B**utadiene**R**ubber (sealant material, such as e. g.: o-rings)
ISO	**I**nternational **O**rganization for **S**tandardization (http://www.iso.org)
M	Symbol for through-drive torque
M_A	Tightening torque
n	Revolution speed
$n_{max.}$	Max. revolution speed
NW	**N**ominal**W**idth
η_{hm}	Symbol for hydraulic-mechanical efficiency
p	Symbol for pressure (**P**ressure)
$p_{min.}$	Symbol for minimum pressure
$p_{max.}$	Symbol for maximum pressure
p_N	Symbol for nominal pressure
p_n	Symbol for maximum operating pressure
p	Connection port (pressure connection)
Q	Symbol for displacement
Q	Symbol for a pump's delivery rate
R	Revolution
SAE	American series of standards (parallel to DIN-EN standards)
WS	**W**rench**s**ize
t	Symbol for time
T	Symbol for temperature
T	Connection port (**T**ank connection)
TÜV	**T**echnischer **Ü**berwachungs**v**erein
V[cm^3/R]	**D**isplacement
V	Symbol for volume (e. g. tank capacity)
V	Symbol for delivery volume
$V_{max.}$	Symbol for maximum delivery volume

Tab. 17: Abbreviations, Symbols and Code Letters (Part 1 of 2)

Abb.	Explanation
∆V	Change in pump displacement
VDI	**V**erein **D**eutscher **I**ngenieure e. V. (http://www.vdi.de)
VDE	**V**erband **d**er **E**lektrotechnik Elektronik Informationstechnik e. V. (http://www.vde.de)
X	Connection port (control pressure connection)
L	Connection port (leakage connection)

Tab. 17: Abbreviations, Symbols and Code Letters (Part 2 of 2)

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12.4 Tightening Torque

Tightening Torque

The data on the tightening torque in this segment is considered as reference values only. Preference should be given to the data provided by each manufacturer of the particular machine part!

Flange for Suction and Pressure Connection

Flanges with corresponding screws and sealing elements are to be used in accordance with the information provided by the flange manufacturer.
Respective tightening torques should be gathered from the information provided by the flange manufacturer or as per standard ISO 6162.

Mounting Screws

As per DIN 13 or ISO 68, in individual cases, tightening torques should be checked in accordance with VDI 2230.

Mounting screws for SAE-A- and SAE-B flange:

Adapter Flange Type	Thread Size	Max. Permissible Tightening Torque
SAE-A	M 10	58 ... 78 Nm
SAE-B	M 10	62 ... 75 Nm
SAE-B	M 12	105 ... 130 Nm

Tab. 18: Tightening Torquefor mounting screws

Sealing Plugs Form E with ED Seal (Reference Values)

Thread Size	Max. Permissible Tightening Torque
M 18x1.5	65 Nm (+10%)
M 22x1.5	90 Nm (+10%)
M 26x1.5	135 Nm (+10%)
G 1/4"	30 Nm (+10%)
G 3/8"	60 Nm (+10%)

Tab. 19: Tightening Torque for sealing plugs

Straight Screw-in Sockets Form E with ED Seals (Reference Values)

Thread Size	Max. Permissible Tightening Torque
M 18x1.5	70 Nm (+10%)
M 22x1.5	125 Nm (+10%)
M 26x1.5	180 Nm (+10%)
G 1/4"	35 Nm (+10%)
G 3/8"	70 Nm (+10%)

Tab. 20: Tightening Torque for straight screw-in fittings

For your notes.

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